VTOL AIRCRAFT

IN THIS ISSUE

SPECIAL INTERNATIONAL SURVEY

11 May 1961
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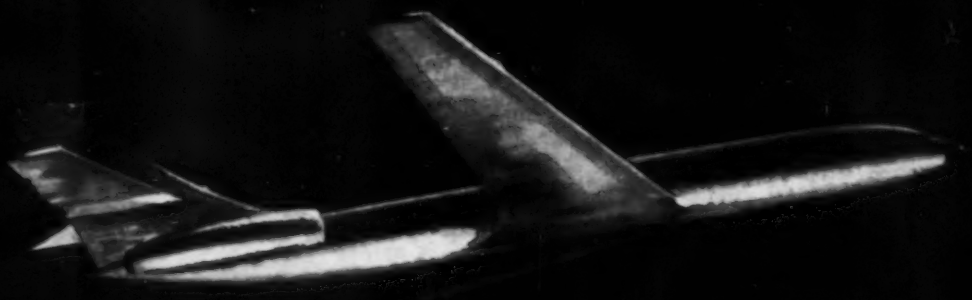

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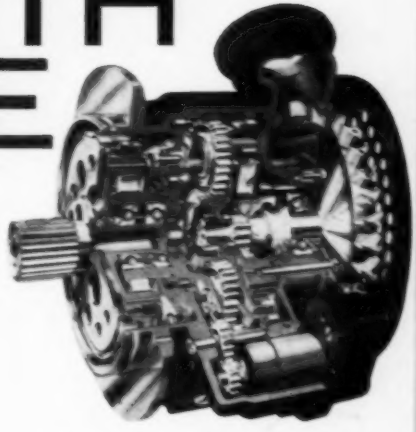

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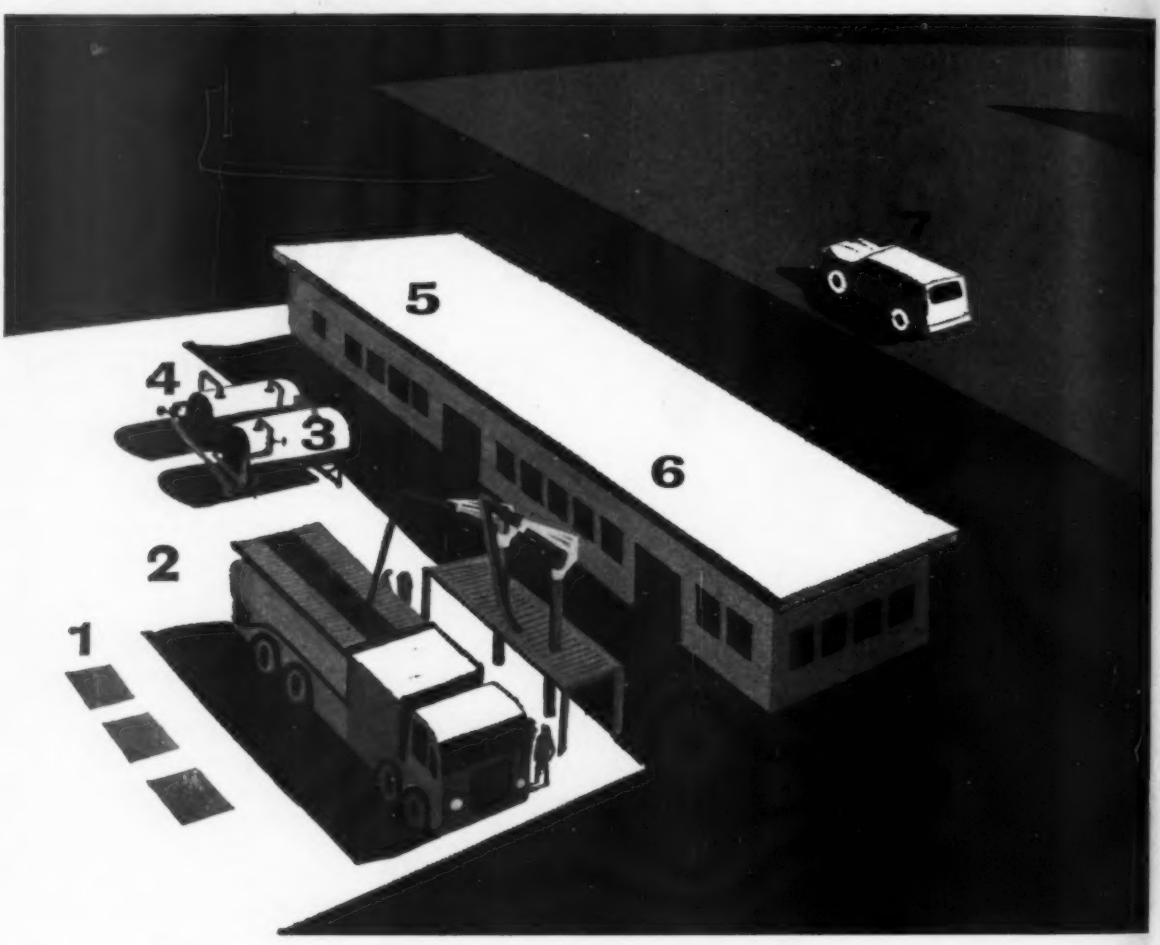

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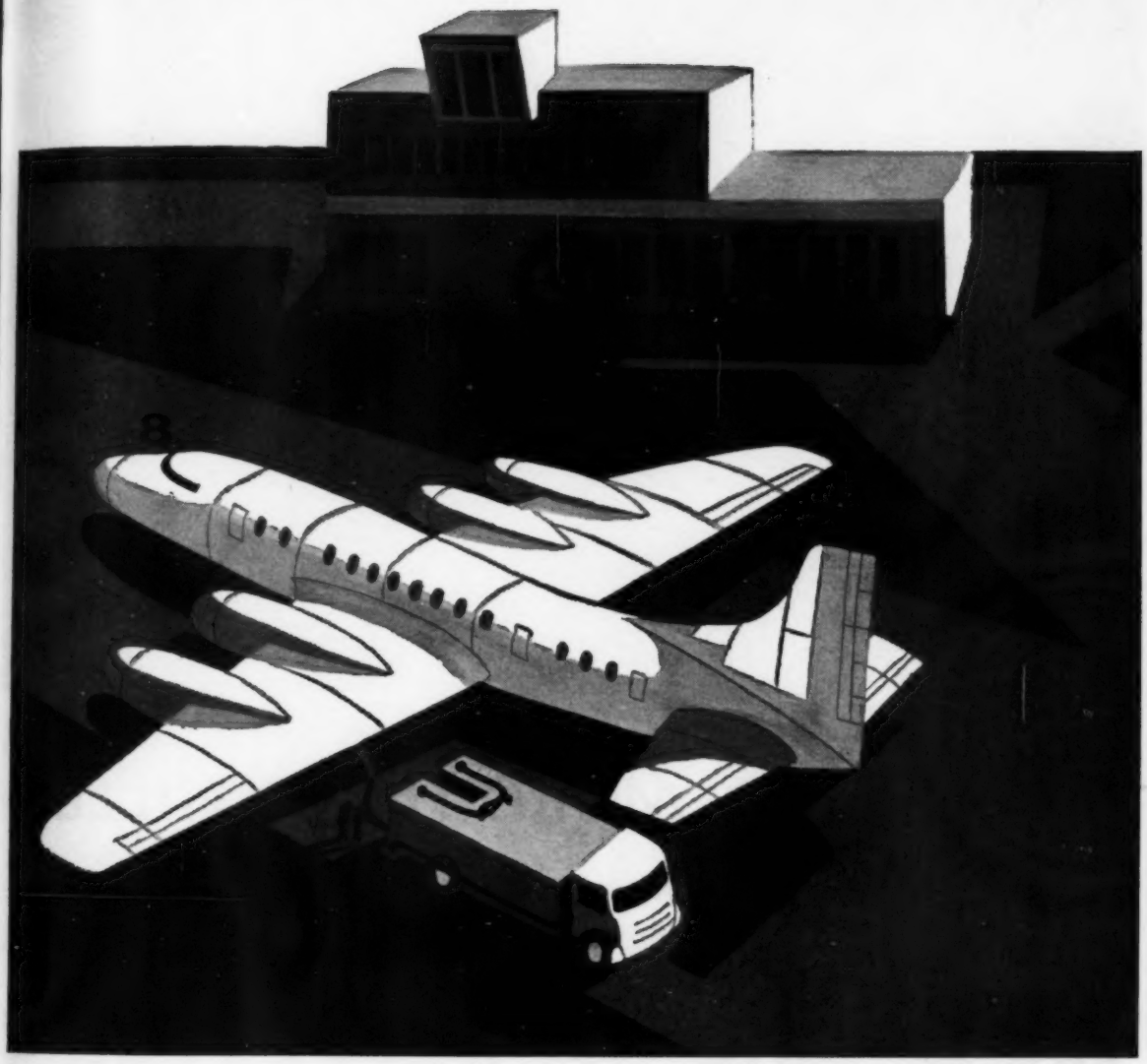

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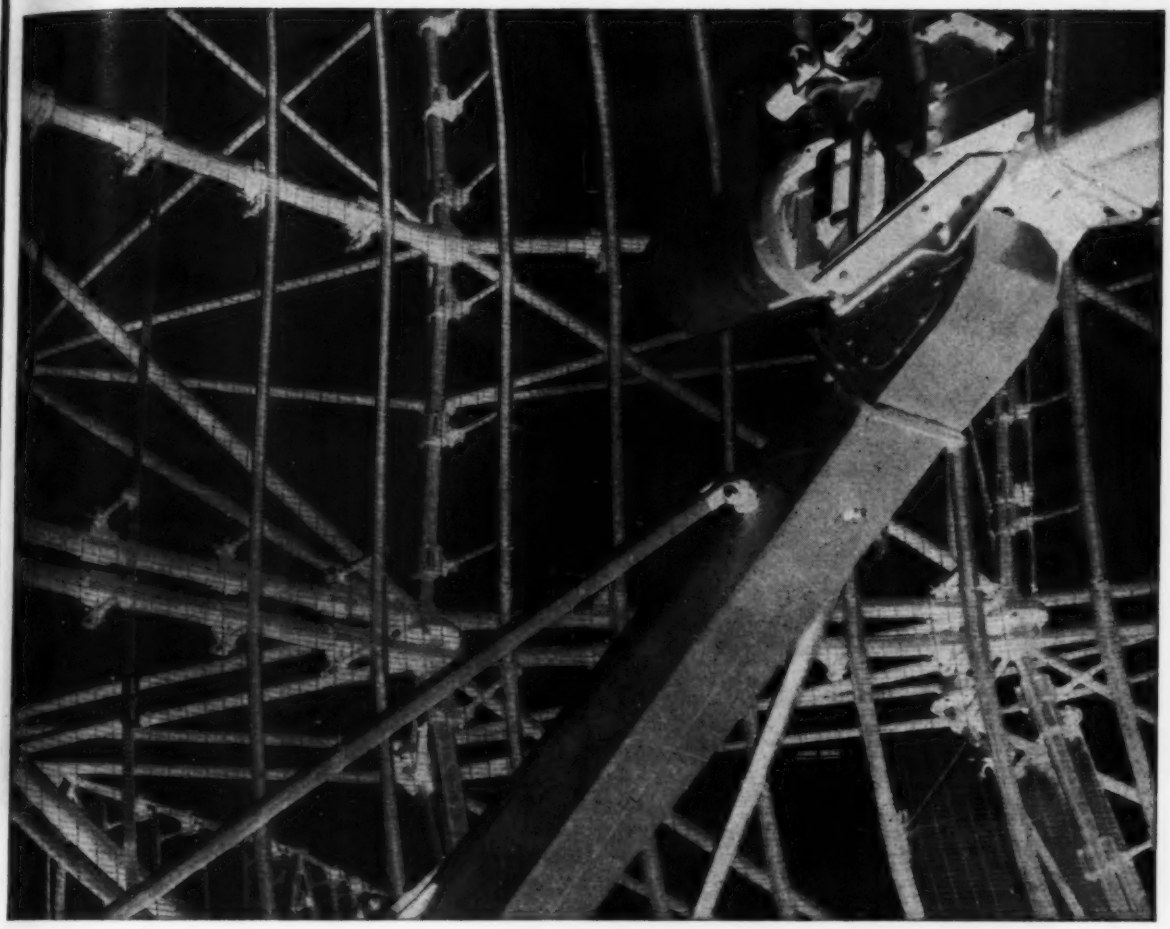

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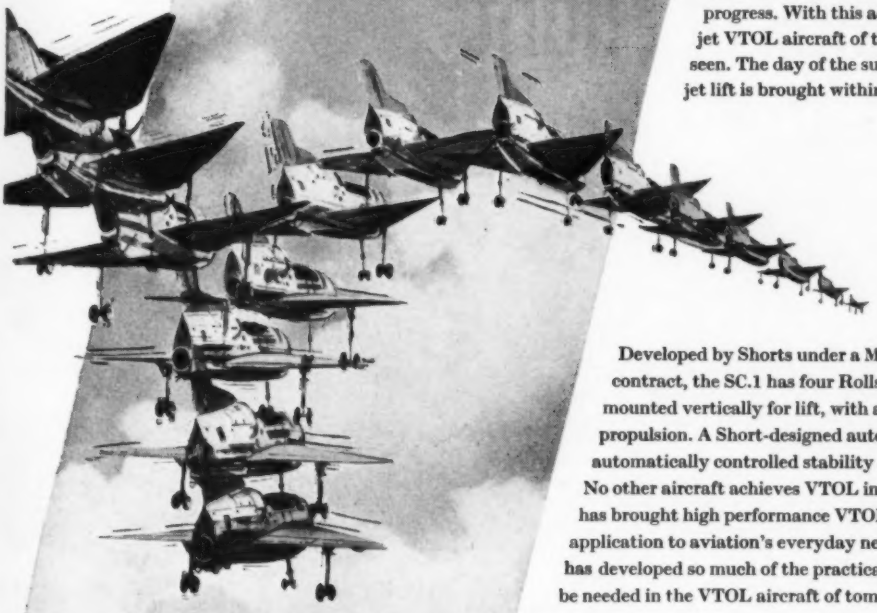

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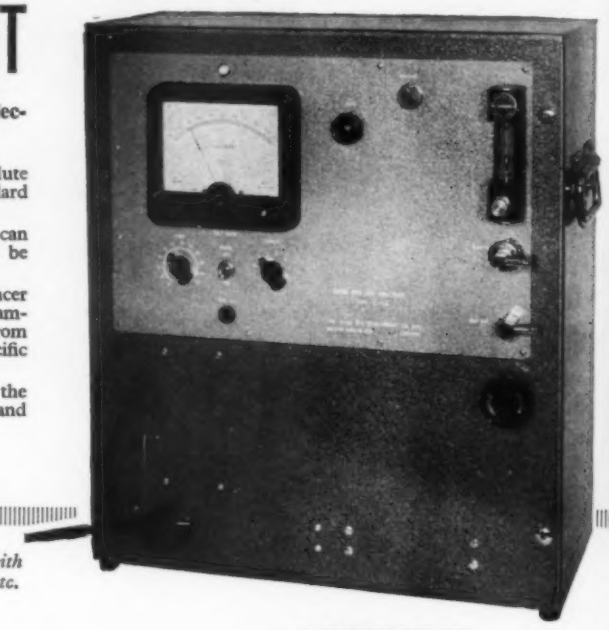

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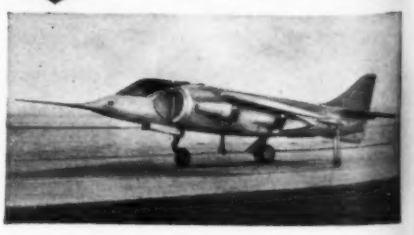
The Hawker P1127 experimental VTOL aircraft is fitted with Refrasil lightweight blankets.



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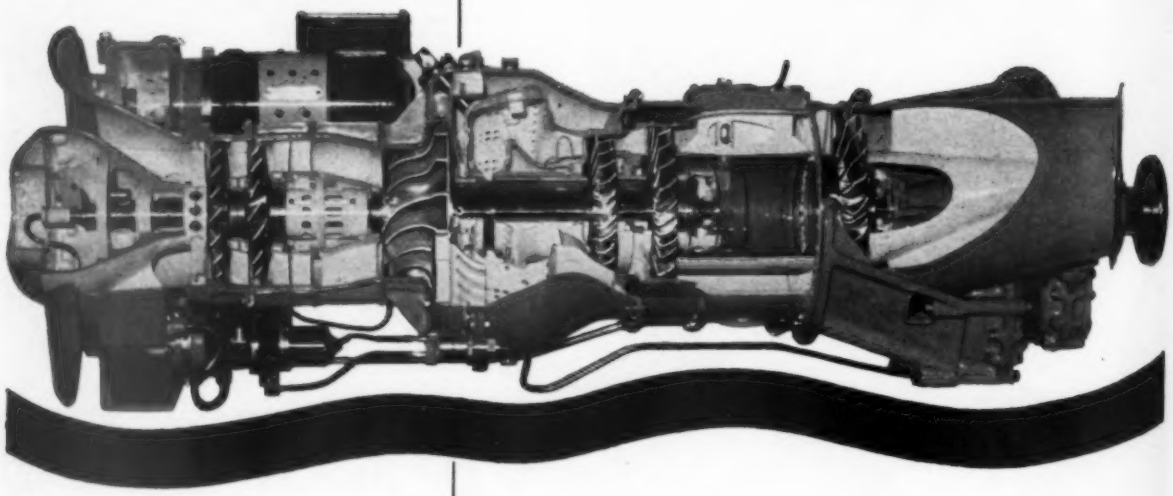

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No 2722 VOLUME 79 THURSDAY 11 MAY 1961

FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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Mercury Makes Good

THE news was good last week. To one man who became a pioneer, and to a team whose faith was proved justified, the world's congratulations were due and were given. Commander Alan Shepard, USN, airman and test pilot, had graduated as astronaut; and the National Aeronautics and Space Administration's Space Task Group had notched another success in their well planned man-in-space programme.

Commander Shepard's ordeal lay not so much in his ballistic flight as in the relentless pressure of the unprecedented world publicity to which he was subjected. NASA, too, has had to face pressure and criticism, including hysterical demands for crash programmes, triggered by Soviet space successes.

It has become almost impossible for NASA to avoid giving target dates, and quite impossible to adjust those dates without attendant headlines proclaiming emergency speed-ups or serious delays. But, as the Director of Project Mercury, Mr Robert R. Gilruth, emphasized in an exclusive interview published in *Flight* last December, "In research and development you can't give target dates." Deliberately, the choice was made to use orbital-type spacecraft for the ballistic shots. "For a Mach 5 or 6 up-and-down shot you don't need the same heat shield or the same life-support system. In that case, we could have gone up and down sooner."

From talks with the Director and staff of the Space Task Group at Langley Field, Virginia; NASA headquarters staff in Washington; Missile Test Center personnel at Patrick Air Force Base and Cape Canaveral, Florida; and with the astronauts themselves, *Flight* has come to have a high regard for the entire team involved in Project Mercury. May their orbital operations be every bit as successful as Commander Shepard's flight of May 5—and may their honest belief in the freedom of the world Press to report these flights commend itself in future to the talented but secretive team whose efforts made possible Major Gagarin's orbital achievement.

VTOL

WITH this issue *Flight* presents its 1961 survey of the world's VTOL aircraft. In past years the review has been entitled "Helicopters of the World," but today it can be seen that the helicopter will in future be just one member of a large family. Its rotor system handles a greater mass flow more slowly than do other vertical-lift systems, so that its inferior cruising speed and range are in some roles offset by hovering efficiency. At the other end of the spectrum are the VTOL combat aircraft, which are not designed for protracted hovering yet in other respects will match their supersonic sisters needing a 10,000ft runway.

Europe is proving a particularly fertile spawning-ground for such aircraft, and at least eight major projects are in hand to meet a NATO requirement for a tactical strike aircraft. These projects tend to have a shape resembling the Swedish Draken, and combine Mach 2 performance with the ability to reach wing-supported flight at 50ft altitude in a horizontal distance of 500ft. Generally, separate engines are used for lift and propulsion, although the only high-speed VTOL aircraft yet to have flown—the Hawker P.1127—has a single lift/thrust engine. Lift-jet packages can even be added to existing aircraft, such as the Mirage III, F-104 and military Argosy. Indeed, the future possibilities are such that there is solid reassurance in the knowledge that the jet-lift field is one in which Britain holds a genuine lead, thanks largely to the work of Shorts, the RAE, Hawker, Rolls-Royce and Bristol Siddeley.

FROM ALL QUARTERS

Saunders-Roe Helicopters

TWO Scouts, powered by Blackburn Nimbus turbines, were delivered on May 1 by the Saunders-Roe division of Westland to the Army at Middle Wallop, where they immediately began intensive flying trials. Ten hours' flying were completed during the following day. Two further Scouts are being prepared for tropical trials and demonstration tours. Scout airframe production is the responsibility of the Fairey division of Westland.

The experimental Turmo-powered Skeeter is now flying with the full four-axis Newmark autopilot destined for anti-submarine Sea Scouts. Height during hovering is automatically controlled through the collective-pitch channel.

Construction of a batch of Hiller Rotorcycles for the US Marines and for Helicop-Air in Paris is continuing and two have been delivered to France. The first fully British-built machine—illustrated here—has flown. Four altogether have been completed, and at least two more are nearing completion.

Coventry was Britain's Busiest Airport

IN an hour and a half during the Shackleton Aviation Weekend at Baginton Airport, Coventry (reported in *Flight* last week), 142 aircraft took off from the single runway. Over the three days of the meeting there were 2,088 movements, and this is believed to be a record for any aerodrome in the United Kingdom at any time. Busiest day was Saturday, April 29, into which nearly half the total movements were concentrated; on that day 956 aircraft took off or landed. On the Friday the total was 412 and on the Sunday 720.

These movements were performed in weather that was at no time really good, and visibility was often less than two miles. Not every pilot, of course, was happy about this unprecedented activity; the number of demonstrations taking place frequently made the circuit area extremely crowded. On a number of occasions aerobatics were being performed over the airfield while other aircraft were in the vicinity. For the record, the number of movements at London Airport between 9 a.m. and 7 p.m. on a Saturday in the height of the summer season averages about 400 to 420.

W. S. Shackleton (Aviation) Ltd, say that next year they hope to have available an even wider selection of new aircraft. There has been some criticism of the layout of the exhibition, so in 1962 some changes will be made. The new aircraft will be concentrated into about half the area used this year and will be grouped separately from secondhand and visiting aircraft. Additional bowsers should be available for refuelling, and it is intended to have a two-hour flying display on the Saturday only. This will leave exhibitors more time to carry out individual demonstrations and leave Sunday free for visitors to arrive by air throughout the day.

Shackleton also remark that two of the Airedales for which they have placed orders with Beagle-Auster have already been resold.

Balloonists 21 Miles Up

TWO officers of the US Navy last Thursday made a balloon ascent to a height of 113,500ft—more than 21 miles. The balloon, with an envelope 411ft high containing 10m cu ft of helium, carried an open gondola, and the two men wore pressure suits. The altitude, which is likely to be submitted to the FAI as a world record, considerably exceeded the existing record height of 102,800ft set up by Capt Joseph Kittinger, USAF, in August last year.

The ascent had an unhappy sequel; one of the two officers lost his life when the balloon—which had been launched from the carrier USS *Antietam*—descended in the Gulf of Mexico. Cdr Malcolm Ross was the pilot, but it was Lt Cdr V. G. Prather who was drowned when he slipped out of the sling of the retrieving helicopter.

APPOINTED DIRECTORS of the ATS Co Ltd, the Hawker Siddeley market information subsidiary, are Air Cdre F. R. Banks (left) and Mr P. G. Lucas (centre). Mr M. N. Golovine (right) continues as managing director. *Details are given on page 620 of this issue*

ROTORCYCLE WALK: Westland Saunders-Roe groundcrew carry the first Saro-built Hiller Rotorcycle back to its hangar at Eastleigh after a test flight. News of Rotorcycle and other Saro projects appears in Col 1

Record Quarter

OVER £41¼m was the value of British aircraft industry exports for the first three months of 1961. This was a record for the first quarter of any year, and as a quarterly total it has been exceeded only once, in the second quarter of 1959. The March figure, £16¼m, was the third highest monthly total ever achieved. It was largely due to record engine exports (over £8m) and the sale of Vanguards to Canada and Comets to the Lebanon. Details of March sales were as follows: aircraft and parts, £7,604,067; engines and parts, £8,185,735; electrical equipment, £327,786; instruments, £213,113; tyres, £94,228. Detailed sales for the first quarter of 1961 were: aircraft and parts, £17,332,950; engines and parts, £22,514,919 (a record figure); electrical equipment, £846,056; instruments, £702,925; and tyres, £231,319. Leading aircraft buyers were Canada, the Lebanon and the US; leading engine buyers the US, Canada and France.

Air-cushion Casualty Evacuation

THE scope of the air-cushion vehicle appears almost unlimited; in its latest application the air-riding machine enters the field of military medicine. Folland Aircraft Ltd—a member of the Hawker Siddeley Group—have developed "an air-supported stretcher carrier" in collaboration with the Royal Army Medical Corps.

The prototype vehicle is supported by plenum-chamber air cushioning in conjunction with flexible side-curtains. A flat-sided oval in plan form, and some 10ft in length and 7ft in width, it provides deck-space for a stretcher on each side of a fore-and-aft housing containing the two small industrial two-stroke engines which drive the fans. There is no "pilot," the vehicle being controlled by a man walking behind it and grasping two lawn-mower-type handles on which are the simple controls. Another in front helps to guide the carrier by means of similar handles.

The project appears to have obvious advantages. Initial evacuation of battlefield casualties is an arduous task often calling for four bearers to carry a single stretcher. The Folland device would enable two men to move two casualties, and the air cushion would give the patients a smoother ride over rough ground. Special attention has been given to reduction of vibration and to silencing.

Another Safety Award for E. S. Calvert

IN *Flight* for April 13 we reported that Mr E. S. Calvert and Mr J. W. Sparke of RAE had been awarded the 1961 Laura Tabor Barbour Air Safety Award in recognition of their development of the line-and-bar approach system and the RAE-Thorn visual glide-path indicator.

Now comes news that Mr Calvert has received another American honour—the Monsanto Aviation Safety Award, which was founded in 1957 by the Monsanto Chemical Co. Recipients are chosen annually by the United States Aviation and Space Writers' Association from a list of candidates nominated by an international selection committee of aviation experts. Mr Calvert, says the Association, was selected to receive the award because he had "greatly advanced the safety of aircraft landings through vigorous and imaginative research on the theory of visual judgements in motion,

resulting in the development of visual aids such as approach lighting and lighting of the landing threshold."

On being presented with the award at the annual meeting of the association in New York last Thursday, Mr Calvert pleaded in a speech for the wider use of operational research groups. The development of the v.g.s.i., he said, was an example, and added:—

"It was recently adopted by both our countries. My group has been given the credit for this, but you might be interested to know that it is doubtful whether we would have pursued the idea as a matter of urgency if it had not been for some excellent operational research done by Gen Caldara's group as early as 1953. [Gen Caldara, as USAF Deputy Inspector-General for Safety, received the Monsanto Award in 1958—Ed.] His group investigated 14m landings and showed that a high proportion of the accidents at landing were due to visual misjudgments in good weather. I had already suspected as much by reading the accident reports, but, as a basis for administrative action, there is all the difference in the world between a mere hunch and an exact statistic supported by unassailable evidence. We did not suspect, however, that the accident rate for this kind of procedural failure was at that time so very much greater for jet aircraft than for propeller-driven aircraft. As soon as we saw the statistics for this, we realized that something had to be done quickly if the civil jets were to operate safely all over the world, and, as it turned out, the technical solution was simple.

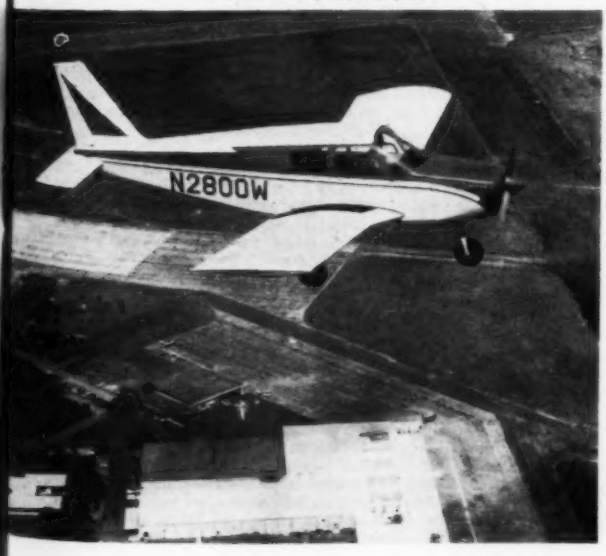
"This shows what could be done if there were small and efficient operational research groups in each country continuously exchanging information. I would emphasize that this work does not require a large number of people (my own staff consists of two), but they must combine scientific knowledge and operational experience with a peculiar kind of insight not very common in this busy uncontemplative world."

NEW PRESIDENT of the Royal Aeronautical Society is Air Marshal Sir Owen Jones. As described on page 612 of this issue, he was inducted last Thursday

New US Executive Aircraft

TWO new business aircraft have just been announced in the USA. One is the Aero Commander 1121, a twin-jet, 500 m.p.h. machine which will fly within one year, be certificated at the end of 1962 and be in production in the third quarter of 1963. Orders are being accepted now and the prices, respectively without and with full electronics, are $475,000 (about £170,000) and $555,000 (about £198,000). No details of configuration or engines are given, but Aero say that the 1121 will retain the short-field capability of present Commanders.

COMING SHORTLY: Flying over Piper's production centre at Vero Beach, and expected in Britain shortly, is the new Cherokee, an inexpensive four-seater powered by Lycoming 150h.p. or 160h.p. engines and "all mod. con." Best cruising TAS is 132 m.p.h. at 7,000ft and endurance at 10,000ft and 60 per cent power, with extra tankage, is 7hr or 800 miles. Price in UK, about £4,200



DESK SET made by Vickers-Armstrongs (Aircraft) Ltd apprentices was presented to Viscount Portal of Hungerford, chairman of British Aircraft Corporation, at the recent annual speech day. D. J. Priest, chairman of the Apprentices' Association, made the presentation

The other new type is the Cessna Skyknight, about which again no firm details of configuration are revealed. A five-passenger twin, it is at present flying and will be in production next year; its main feature is the use of turbo-supercharged Continental 260 h.p. engines, which will maintain full take-off power up to 16,000ft and allow a single-engined service ceiling above 17,000ft. The Skyknight will be able to cruise at 265 m.p.h. at 16,000ft and fly at 27,000ft for long distances. It will "be priced lower than any aircraft of competitive performance" and is part of the planned extension of the range of Cessna twins.

The RAF and USAF Remember

IN a silent processional through St Clement Danes last Sunday morning, with the city quiet and sunlight streaming through the high windows, eight books of remembrance containing the names of those who gave their lives in the RAF and its associated services during the Second World War were borne to glass-fronted shrines in the north and south aisles of the church. They had been dedicated by the Bishop of Maidstone, the Rt Rev Stanley Betts, who is Bishop to the Forces; and the bearers represented all ranks of the RAF, WRAF and PMRAFNS. There are over 105,000 names in the books, and the work of inscribing them has been carried out by members of the Society of Scribes and Illuminators. In an afternoon service at the historic London church, an American book of remembrance was dedicated, containing the names of 19,000 US airmen killed during the war whilst based in Britain.

(*Further "From All Quarters" news items appear overleaf*)

IN BRIEF

The Duchess of Kent "scrambled" four Victors of 15 Sqn at RAF Cottesmore on May 3, when she presented the squadron with its Standard.

Bristol Siddeley announce that the BS.53 lift/thrust turbofan—power-plant of the Hawker P.1127, and chosen for several projects—has been named Pegasus.

MILITARY SALES of British Aircraft Corporation products in Europe and USA will be the respective responsibility of Air Chief Marshal Sir Hubert Patch (left) and AVM W. C. Sheen. (Details are given on page 620)

The Guild of Air Traffic Control Officers now has its headquarters at 14 South Street, Park Lane, London W1.

AVM V. Hancock is to take over as Chief of the Air Staff, RAAF, on May 29 with the rank of air marshal. His appointment to succeed Air Marshal Sir Frederick Scherger was announced last September (*Flight*, September 23, 1960).

Under an agreement between Marcel Dassault and the Woden Transformer Co Ltd, Bilston, Staffs, British-designed electro-mechanical equipment is to be produced in France for the French company's aircraft and guided-missile programme.

Accidental launching of a Sidewinder missile from an F-100, which resulted in a B-52 being shot down over New Mexico on April 7, has been stated to have been caused by "moisture seeping into an electrical connection." The F-100 pilot, a member of the Air National Guard, has been exonerated.

The US Air Force will spend $52.5m on basic research in fiscal year 1962, according to Dr Knox T. Millsaps, Chief Scientist of the Air Force Research Division. For both basic and applied research, the USAF has been spending $3.5m to $4.0m per year in Europe, and also allocates some additional money for projects to be carried on in South American countries, in Australia and Japan.

FROM ALL QUARTERS . . .

Presidency and Presentations

AT the Royal Aeronautical Society last Thursday the new president was inducted and awards were presented for papers published during 1960. The 1961-62 president is Air Marshal Sir Owen Jones, KBE, CB, AFC, BA, DIC, FRAeS, MIMechE; he was inducted by the retiring president, Dr E. S. Moult, CBE, BSc(Eng), FRAeS, MIMechE, who presided at the annual general meeting and presented awards.

Sir Owen Jones served in the RAF from 1924 to 1956, his last post before retirement being that of Controller of Engineering and Equipment at Air Ministry. Since then he has been a consultant and is also an independent member of certain Government committees. He joined the RAeS in 1947, was elected a Fellow in 1950, has served on the council since 1955 and is a former vice-president (1957-60).

Awards for papers were made as follows:—

Simms Gold Medal: Prof D. B. Spalding, MA, PhD, AMIMechE, Professor of Heat Transfer at Imperial College (*Heat and Mass Transfer in Aeronautical Engineering*); **George Taylor (Australia) Gold Medal:** A. J. Troughton, MA(cantab), AFRAeS, chief structural and mechanical engineer, Sir W. G. Armstrong Whitworth Aircraft (*Relationship Between Theory and Practice in Aircraft Structural Problems*).

Edward Busk Memorial Prize: C. Bourque, MSc, and Prof B. G. Newman, PhD(sydney), MA(cantab), AFRAeS, Professor of Aerodynamics, McGill University (*Reattachment of a Two-dimensional, Incompressible Jet to an Adjacent Flat Plate*); **Orville Wright Prize:** Prof W. H. Wittrick, PhD, MA, AFRAeS, MIAS, Professor of Aeronautics, University of Sydney (*Analysis of Stress Concentrations at Reinforced Holes in Infinite Sheets*); **Herbert Akroyd Stuart Memorial Prize:** J. S. Alford, BSME, AFRAeS, ASME, SAE, designing engineer, large-jet-engine department, General Electric Co, Cincinnati (*Powerplants for Supersonic Transports*).

Branch Prize: Lt Cdr D. J. Whitehead, AFC, ARAeS, RN(Ret), chief test pilot, Blackburn Aircraft (*The Low-speed Approach and Catapult Launch Problems in High-Performance Naval Aircraft*); **Usborne Memorial Prize:** T. W. F. Moore, BSc, MSc, GradRAeS, guided weapons department, Bristol Aircraft (*Some Experiments on the Reattachment of a Laminar Boundary Layer Separating from a Rearward-facing Step on a Flat Plate Aerofoil*).

HOME FOR HISTORY: The top floor of the Science Museum extension (see news-item below) ready to receive the aeronautical exhibits

Hangaring the Aeronautical Collection

WHAT looks like an aircraft hangar has recently been completed at the top of the three-storey block being built by the Ministry of Works as an extension to the Science Museum, South Kensington, London SW7. As a new gallery to house the museum's aeronautical collection, it forms a fitting environment for the famous contents at present being moved there. When this move is completed, it will take from nine months to a year to rearrange the collection.

Transfer of the exhibits, which will take several weeks, has already begun. Many of the old aircraft are extremely fragile and are being carefully crated. Exhibits that are too bulky to be moved up inside the building will be lifted by crane to the roof.

The new gallery (see accompanying illustration) is 225ft long, 80ft wide and 30ft high to the centre of the roof. Colour-scheme is light blue for the tubular steel arches, white for the lattice-work; end walls are purple (where they adjoin the tea-room) and grey-green. Many of the historic aircraft are to be suspended from the roof at different heights. When they are in place the Ministry of Works are to build "a meandering light steel walkway" to facilitate inspection at close quarters.

MAKING INERTIAL GYROS

Inspection of a MIG spinner assembly, using a ×30 optical system, at the English Electric Aviation works at Stevenage

AN important section of the vast English Electric guided-weapons plant at Stevenage, Herts, is the Instrument Wing. Employment in the GW Division is now of the order of 6,000; the Instrument Wing accounts for some 400, and may before long be twice as large.

The Wing began as an essential part of English Electric's establishment of comprehensive facilities capable of handling an entire missile programme. Initially, efforts were concentrated upon displacement and rate gyros for Thunderbird, but with the advent of the company's Blue Water project, with an inertial guidance system, it was decided to obtain a licence for the Minneapolis-Honeywell miniature integrating gyroscope (MIG), which weighs but 7oz and introduces wholly new standards of accuracy. The MIG has now been in production at Stevenage for two years, and is the only miniature inertial-quality gyro in production in Europe.

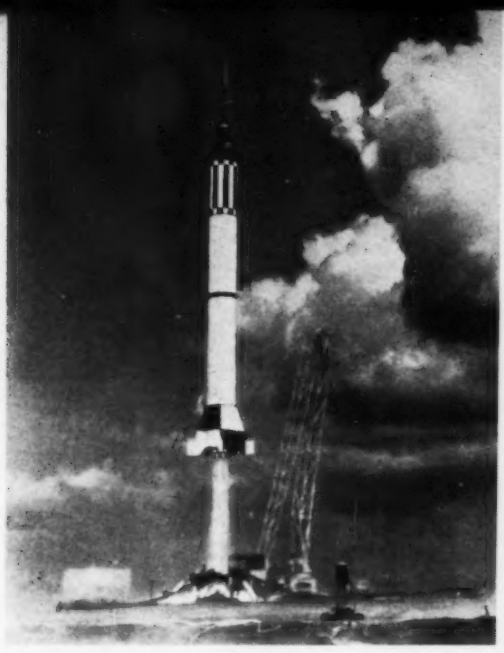
As illustrated on page 478 of *Flight* for April 12, 1957, the MIG employs a gimbal floated at neutral buoyancy in a fluorocarbon fluid and pivoted between jewelled bearings. The manufacture and assembly of such a gyro calls for standards of precision unprecedented not only in industry but even in specialist laboratories. A chain is as strong as its weakest link, and in order to maintain accuracy in a finished product measured in millionths of an inch it is essential to keep every link in the chain from raw material to final despatch to such a standard as virtually to eliminate error.

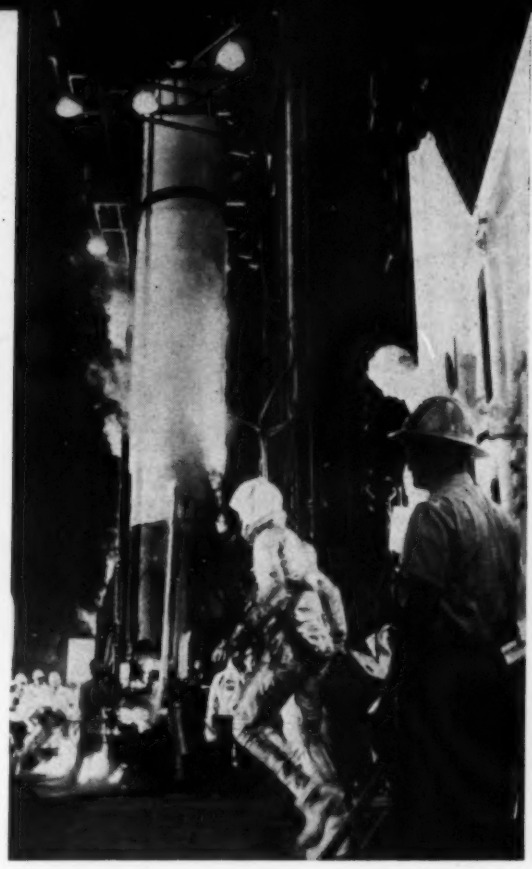
One such source is vibration. The Instrument Wing is located between the Eastern Region main line to the north and the new Stevenage by-pass road, and further vibration comes from machinery in the company's plant—and even from the footfalls of the staff. Accordingly, test equipment is mounted on concrete plinths carried on 50-ton concrete rafts supported on air bellows resting on heavy foundations deep in the earth. Special measures have been taken to reduce vibration caused by the wind, and all powered machinery is far removed from the final assembly and test area.

In this test area, covering 30,000 sq ft, temperature and humidity are precisely controlled and no dust particle larger than 0.0000039in is allowed to enter. Access to the building is gained only through changing rooms wherein the visitor dons special dust-free Terylene smocks and caps; and to enter the super-clean final-assembly areas it is mandatory to wear anti-static boots and, for certain assembly operations, finger-stalls. Moreover, actual assembly is done beneath pressurized shrouds into which super-clean air is pumped continuously.

Two items of test equipment which are unusual, if not unique, are a vertical bouncer, for imparting precise linear accelerations, and a centrifuge in which accelerations of up to 10g can be imparted at a radius of up to 30in at extraordinary orders of accuracy. More specialized test gear has also been developed, including the IFG.106 equipment—which can carry out a full range of tests on a rate-integrating gyroscope and is in production for MIG users—and a unique direct-reading permeameter which gives instantaneous readings of permeability.

In addition to such standard products as the Mk 8 rate-gyro and the MIG GG.49, Stevenage has developed PIM (precision indication of the meridian), in which a rate-integrating gyro can in twenty minutes determine the east/west line about which the component of Earth's rotation is zero. True north can thus be determined within one minute of arc (the gyro could detect one revolution in 20 years), and PIM has many industrial uses in addition to its immediate task of aligning guided missiles when other direction indications are absent. Recently, the company has concluded an agreement with Northrop for the manufacture of large inertial-quality gyros for marine navigation, and the unique techniques and processes which have become routine at Stevenage are gradually being found of value in fields far removed from the original one of guided weapons.





Above, Mercury-Redstone launch MR-3 from Cape Canaveral at 0934hr local time on May 5. Right, the astronaut arrives at the launch-pad lift at 0515

Missiles and Spaceflight

FIRST AMERICAN IN SPACE

by Wm Hines, "Washington Star"

Cape Canaveral, Florida, May 5

THE first manned American spaceflight attempt was successfully concluded between 0934 and 0949hr local time today. Mercury Astronaut Alan Bartlett Shepard, 37-year-old professional naval officer, flew in a space capsule boosted by a 75,000lb thrust liquid-fuelled (alcohol-lox) Redstone.

The shot was almost unbelievably successful. Though plagued by weather and equipment "holds" that delayed the shot 7½hr beyond its originally scheduled lift-off of 0700 on May 2, once the mission's countdown reached zero the performance was flawless.

The rocket operated within 2.5 per cent of "nominal." The flight profile called for a maximum altitude of 100 n.m. and a maximum range of 250 n.m. Achieved distances were 100 and 254 n.m. respectively. Speed at burnout was 5,160 m.p.h., markedly above the planned speed of 4,500 m.p.h. but not disturbingly over nominal.

Shepard, one of the seven men undergoing special training for space missions, was as machinely perfect as the rocket and capsule in which he rode. "It was an honour and a privilege to watch Alan Shepard at work today," said Walter Williams, test director; "he was a true engineering test pilot."

Dr Stanley White, medical chief for Project Mercury, said Shepard experienced "very little change in pulse, respiration and temperature throughout the launching." Data telemetered from the capsule revealed that at the point in re-entry at which Shepard was experiencing maximum g-loading (approximately 10g) his pulse rate was 120. After the parachute system opened, slowing his rate of descent to approximately 30ft/sec, the heartbeat slowed to 100. Shepard's normal pulse is about 80.

The shot, officially designated MR-3 (meaning the third Redstone launch in the Mercury series) was programmed to have a duration of 15min. Shepard's capsule was parachuted into the ocean after 14min 55sec at a point described as 27° 13' 7" N, 75° 53' W. This is in international waters about 135 n.m. east-northeast of Grand Bahama Island, in the British-owned Bahamas group.

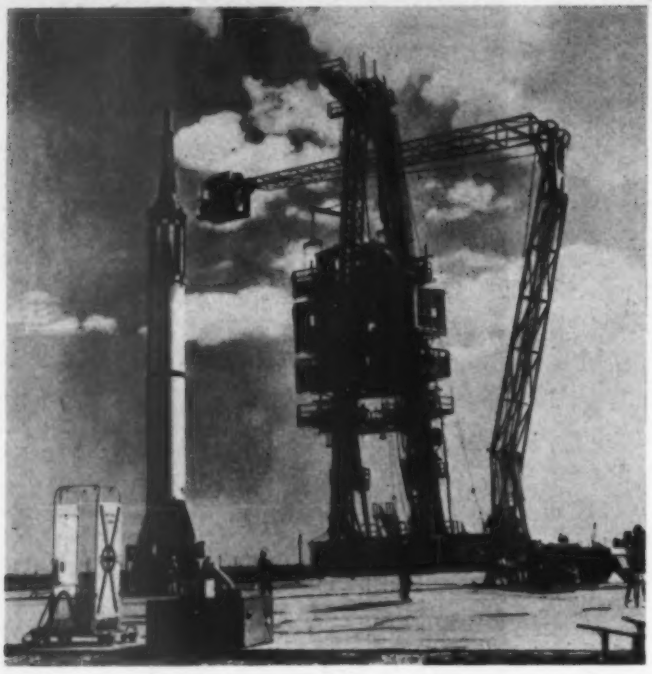
By strictly scientific-technological standards, the MR-3 shot was one of limited objectives. In the context of the Mercury programme it was a test of man and materiel undertaken to provide data for flights in the MA series (A for Atlas), of which No 7 is planned as a manned three-orbit mission. MA-7 is officially scheduled at present in the last three months of 1961, but most informed guesswork holds early 1962 as a more likely firing time.

Dr Hugh L. Dryden, the internationally known aeronautical scientist who is deputy administrator of the National Aeronautics and Space Administration, emphasized that the scientific aspects of MR-3 were limited. "There have been *some* scientific accomplishments from this flight," Dryden said, stressing the word "some," "but I do not wish to emphasize unduly the scientific progress made in the flight."

But scientific and technological aspects aside, the shot—because

(continued on page 615, after "Preparations for MR-3" feature)

Right, Cdr Shepard climbs aboard the Mercury spacecraft, which was designated "Freedom 7," before the launch. Far right, Shepard is winched up into the HUS-1 helicopter, piloted by Lieuts Wayne Koons and George Cox, which also brought back the capsule seen in the water below



Left, unique design against the Florida sky: Mercury-Redstone rocket, servicing tower and "cherry-picker" designed for emergency escape of astronaut on pad. Above, Little Joe test of Mercury escape system, April 28, Wallops Island

Missiles and Spaceflight . . .

PREPARATIONS FOR MR-3

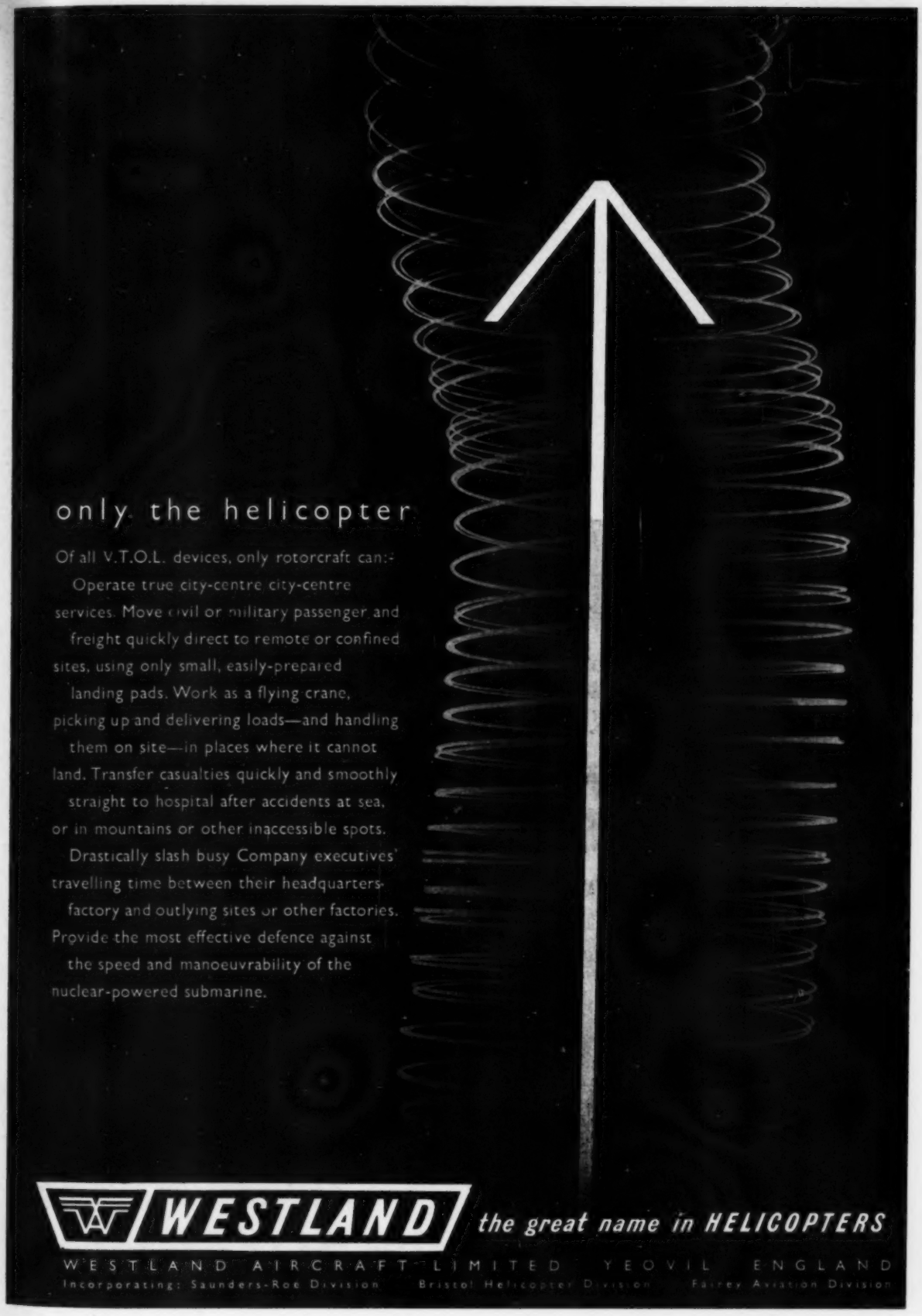
Initially scheduled for the morning of Tuesday, May 2, the first manned flight in Project Mercury—a ballistic shot 290 miles down the Atlantic Missile Range from Cape Canaveral—was postponed more than once because of weather. Preparations for the launch followed the successful final test on April 28 of the Mercury escape system. In this firing, by Little Joe booster from the Wallops Station of the National Aeronautics and Space Administration, Wallops Island, Virginia, an unmanned Mercury capsule was fired to a height of 14,000ft. The planned altitude was 40,000ft, but a NASA spokesman said that the acceleration experienced was more severe than would occur during a Mercury or Atlas mission and that the test had proved that a man could have survived the flight. The Mercury escape system worked well.

As briefly reported in last week's issue, the escape system had also functioned successfully in the unsuccessful attempt on April 25 to place an unmanned Mercury capsule into orbit from Cape Canaveral. The main purpose of this Atlas-boosted flight was to test the means of bringing the spacecraft back to Earth within the planned recovery area after completion of a single orbit.

The blaze of publicity which attended the preparations for the Mercury-Redstone ballistic flight from the Cape—some 500 journalists and radio, television and film commentators and cameramen were on hand—was in ironic contrast to the official silence which preceded the orbital flight by Maj Gagarin on April 12. Only the name of the chosen astronaut was withheld, until after the official announcement that the May 2 flight had been postponed. It was then disclosed that Cdr Alan Shepard was to make the flight, with Lt-Col John Glenn as reserve. Some of the preparations for the launch are pictured on this page.

Above, Cdr Alan B. Shepard Jr of the US Navy was selected to make the first Mercury ballistic flight. Below, the Mercury capsule recovered after the unsuccessful Atlas orbital attempt of April 25

In a simulated Mercury test flight, the spacecraft is occupied by Lt-Col John H. Glenn Jr, first reserve to Shepard for the first flight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The men who fly these machines have a training second to none in the world, starting with a six months' course at the Britannia Royal Naval College, Dartmouth. The basic qualities required of to-day's officers of the Fleet Air Arm are the same as in Nelson's day – initiative, intelligence, resourcefulness and determination.

The responsibility is great and the rewards are equal to it – adventure, enjoyment, travel – and after 12 years a tax-free gratuity of £4,000 or £1,500 after 8 years.

Of course only a select number can qualify as pilots and observers. But why shouldn't *you* be among them? You must have a zest for flying, be attracted to the Naval way of life and be able to pass the Interview Board which is designed to test your fitness, intelligence and character.

The age limits for entry are 17–25. You must have passed the G.C.E. at "O" level in English Language, Mathematics and two other approved subjects (*three* other approved subjects after 1st September 1961).

When qualified, pay at age 20 is £949 a year; a married officer of 25 can receive up to £1,760 a year. Selected officers serving on a 12 year engagement have the opportunity of transferring to a pensionable career.

New 5-year commissions for Helicopter Pilots

There is a new scheme of engagement for men wishing to specialise as helicopter pilots only. They join between ages 17 - 26 on a 5 year commission and receive £775 tax-free gratuity on termination.

Send for the new illustrated booklet "Fly with the Fleet Air Arm" which will give you full details.

Fly as an officer in the ROYAL NAVY

The Admiralty, D.N.R. (Officers), Dept. FR/27, Queen Anne's Mansions, London, S.W.1.

PAA 16

Missiles and Spaceflight . . .

FIRST AMERICAN IN SPACE (*continued from page 613*)

of its amazing success—gave the United States an opportunity to recoup some of what many people regard as its lost prestige in space. It is widely accepted here that Shepard's brief ride is no answer to Cosmonaut Yuri Gagarin's orbital flight. It is felt, however, that the conduct of the mission in the full glare of publicity added an ingredient which the Soviet Union has never chosen to sprinkle into its space pudding.

More than 500 representatives of news outlets, including dozens from a total of ten foreign countries, attended the launching. Not all—including here some Americans—were completely in sympathy with what was being attempted. However, they were given full information with only the understanding that it would not be used until the countdown reached T-minus-ten. The rule was bent almost beyond recognition, but was not broken.

A taped recording of the radio "chatter" during the astronaut's flight was played back a few hours after the launch. It revealed in detail the absolute precision of the mission. Highlights follow.

About one second after zero, Shepard announced "Lift-off and the clock is started." This referred to a digital timekeeper zeroed on the moment of ignition.

At T + 30 he reported a g-loading of 1.2, and nominal conditions in the cabin. This was the first of a series of periodic reports Shepard was instructed to give on tne following points: H_2O_2 fuel supply for control system; g-loading experienced by pilot; pitch angle of the craft; cabin pressure in lb/sq in, and a statement whether the cabin oxygen supply was satisfactory.

Shepard reported g-load build-up to slightly under 6 about 2.5min out, when the rocket was approaching burnout. His pitch angle was as programmed throughout. Cabin pressure remained at 5.5lb/sq in (about 0.4 atm), and the oxygen supply remained in a "go" condition throughout.

The astronaut probably added a new phrase to the English language by his repeated use of "A-OK" to report satisfactory conditions in flight. On the way back to Cocoa Beach, Florida, six miles south of the Cape, newsmen were shouting "A-OK" to one another, and many used the phrase in their stories. It means "all OK."

Three minutes after launch, computer readouts in the Mercury Control Center enabled spokesmen to announce "It looks like a nominal impact," meaning that the trajectory established under powered flight was a parabola with its farther end in the ocean near the planned impact area. At T plus 7min 10sec the control centre predicted an impact point seven statute miles over nominal, which was what happened—297 miles, compared with 290 in the programme.

The capsule was spotted visually on re-entry by telescopic instruments aboard naval ships in the drop zone. The visual sighting was confirmed by radar when the 63ft canopy parachute opened slightly more than 10,000ft up. Helicopters from the aircraft carrier *Lake Champlain*, a 40,000 ton ASW vessel, were orbiting the impact area above the capsule as it parachuted into the water.

"He was out of the capsule and into a helicopter (a Sikorsky HUS-1 of the Marine Corps) within 5min, and the capsule was lifted by the 'copter a minute later. It landed on the *Champlain* at ten o'clock," said the Flotilla Commander, Rear-Admiral V. F. H. Hilles.

Shepard got out of the helicopter on the *Champlain's* deck, walked to a sick-bay area for a preliminary medical examination, and was summoned to the telephone to speak with the President of the United States. Later he was taken to Grand Bahama for a detailed physical and psychological check, and "de-briefing" by NASA officers and his fellow astronauts.

A press conference, at which time Shepard would have his first post-launch exposure to newsmen's questions, was scheduled for May 8, at the State Department auditorium in Washington.

MAY DAY IN RED SQUARE

Although it was one of the largest of recent years, the 1961 May Day (May 1) parade through Red Square, Moscow, was not the occasion of any great disclosures. The mixture as before (perhaps more so) tramped and roared past the Lenin Mausoleum, from which Maj Gagarin smiled and waved beside Mr Krushchev during four near-freezing hours. Following the armoured vehicles, guns and multi-barrelled rocket launchers, came the following guided or spin-stabilized missiles:—

(1) Eight surface-to-air missiles, on articulated transporters. These Nike-like two-stage weapons, said to be called M-2, were hailed by the Tass radio commentator as having been responsible for bringing down Powers' Lockheed U-2 exactly one year previously.

(2) Eight surface-to-air missiles, on articulated transporters basically similar to those used for item 1. This weapon, a designation for which has yet to be invented in the West, is slightly larger than the tandem-boost pattern, and differs in several major respects. The boost motor is not a large tandem unit with fins and trailing-edge controls, but is simply a high-thrust, short-duration charge forming the first stage of the internal propulsion system. Flight control is effected by cruciform foreplanes, used in conjunction with a cruciform of wings of greater span than those of "M-2."

(3) Four spin-stabilized rockets carried on the standard airborne, amphibious, tracked chassis. Said to be designated Type T-5A, these specimens differed only slightly from examples seen previously.

(4) Four spin-stabilized rockets carried on the same chassis as item 3. Said to be designated T-5C, these employ the same motor as T-5A but have a much heavier warhead, with a cylindrical case of some 20in diameter.

(5) Eight spin-stabilized rockets carried on the JS.3 tank chassis. Said to be designated T-5B, these weapons have a still larger warhead—certainly big enough to be nuclear—attached to the front of a fatter motor which before firing is protected by a heavy covering drum—probably to hold the propellant charge at a suitable temperature in an Arctic environment.

(6) Four tactical ballistic weapons carried on a JS.3 chassis. Said to be called T-7A, these missiles weigh some 10,000lb each, and appear to be launched vertically.

(7) Two pairs of tactical ballistic missiles, on four-wheeled trailers towed behind tracked tugs in which ride the launch crew of 20. These missiles appeared to be identical to those called "T-1" or "M-101," first seen in the 1957 October Revolution parade. Apart from generally cleaning-up and painting the missiles and vehicles to an exhibition standard—something noticeable in the last two May Day parades—the only change evident was a flat instrumentation fairing leading from the warhead to the base of the upper tank section.

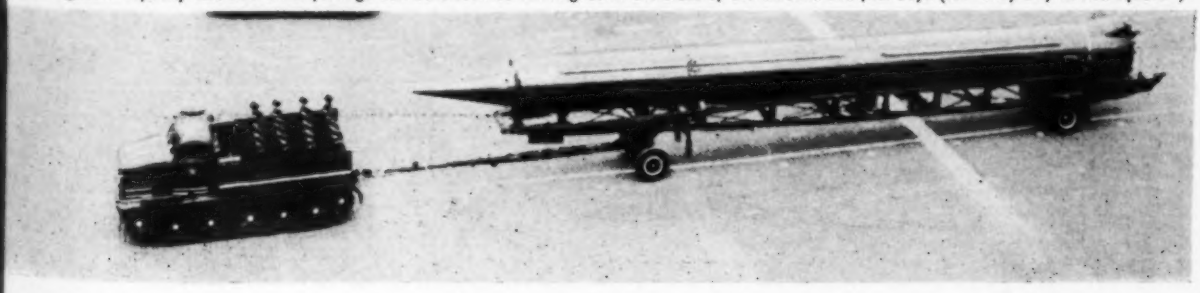
(8) Two pairs of "stretched" versions of item 7. These weapons were the only wholly new missiles in the parade, and clearly represent a major development with substantially increased payload/range. It is estimated that the overall length has been increased from 55ft to about 63ft, and both tank sections carry four axial instrumentation and pipe fairings, spaced 90° apart, similar to those of Titan.

EUROPEAN CO-OPERATION

Speaking in the French National Assembly on May 4, M. Guillaumat, Minister for Public Functions, suggested that a first possibility for a joint European space programme could be a heavy Earth satellite equipped with instruments for astronomical observation.

A second project, which should be feasible within the next seven years, would be to equip a heavy lunar satellite to be launched by a powerful rocket not yet available, after which an automatic observatory might be sent to the Moon.

Below is the lengthened version of the tactical ballistic missile said to be designated "T-1" or "M-101"; the tankage sections have much greater capacity and new axial fairings can be discerned running down the sides of the oxidant and fuel bays (see "*May Day in Red Square*")



Mock-up of the first joint US/UK satellite, due to be launched early next year by Scout from Wallops Island to carry out ionospheric experiments. Satellite hardware is now being tested at Goddard Space Flight Center, Greenbelt, Maryland, where this picture was taken

Missiles and Spaceflight . . .

POLARIS OPERATIONS

In an interview with the naval correspondent of the London *Daily Telegraph*, Capt N. G. Ward, commander of US Submarine Squadron 14, revealed that the depot ship *Proteus* (*Flight*, March 30 last) is maintained under one hour's notice to depart, even though she is expected to remain in Holy Loch for some two years. The first ship built as a Polaris depot ship from the keel up is to be named *Hunley*, and she should be completed this month, a year ahead of schedule. USS *Patrick Henry*, the only FBM submarine so far to have been served by *Proteus*, took on replacement missiles in Holy Loch during March and, manned by her Gold Crew, made a shake-down cruise between April 1 and 3 and left on "cold-water patrol" on April 10.

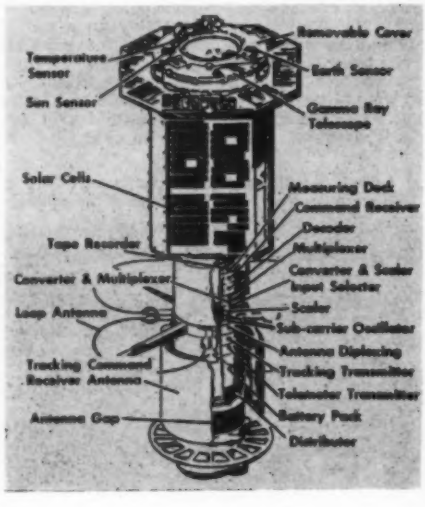
On April 27 the first FBM submarine, *George Washington*, arrived at Holy Loch and tied up to *Proteus*, following a two-month patrol in the Atlantic, during most of which time she was submerged. Last month the Civil Lord of the Admiralty visited Greenock, and while there announced that statements to the effect that coded signals had been passing between the Scottish mainland and a Soviet trawler were false.

EXPLORER II DETAILS

Illustrated at right is the Explorer 11 gamma-ray astronomy satellite successfully launched on April 27 from Cape Canaveral by Juno 2 rocket. Primary objectives of the experiment were to detect high-energy gamma rays from cosmic sources and to map their distribution in the sky, and this was the first attempt at this type of space astronomy from a satellite.

The satellite was designed to tumble end-over-end in orbit at the rate of about 10 r.p.m. This motion enables the gamma-ray telescope to scan a portion of surrounding space every 6sec. Sun and Earth sensers enable the exact orientation of the satellite to be established with respect to the Earth, Sun and stars. Attached to the payload in orbit is the 44in long fourth-stage rocket, which acts as part of a transmitting aerial.

Scientific management for the project was provided by NASA's Goddard Space Flight Center, with the Marshall Space Flight Center holding responsibility for designing and building the satellite structure. The experiment is conducted by Dr William Kraushaar and Dr George Clark of Massachusetts Institute of Technology, where the gamma-ray telescope was developed and built. The Juno 2 launch vehicle comprises a first-stage modified Jupiter and three solid-propellant upper stages provided by JPL.



The RAF Institute of Aviation Medicine is "exploring the possibilities" of designing biological experiments which might be flown in satellites. This was stated in the Lords on May 3 by Earl Jellicoe during the debate on the Air Estimates.

At a parade at RAF Feltwell, Norfolk, on May 4, RAF Bomber Command assumed responsibility for training Thor IRBM personnel. Previously all such training has been handled by the US Air Force and Thor contractors.

An 80ft diameter steerable radio telescope is to be built at a site near Crowthorne, Berkshire, for the DSIR Radio Research Station "for work in the space research programme and to study certain other aspects of radio science." The instrument is expected to begin operating towards the end of 1963.

On May 4 a spokesman for the West German defence ministry confirmed the rumour that the Pershing selective-range ballistic missile is to be bought for the German army. It will replace the TM-76B Mace—by the same manufacturer, Martin—a DM480m order for which is now cancelled.

Douglas Aircraft announced on April 13 that "The programme to integrate the Skybolt ALBM with the Vulcan bomber is moving smoothly ahead." This followed the return to Britain of an eight-man Avro team, headed by Mr T. A. House, project designer; representing the MoA were Messrs J. W. McIvor and Eric Campbell.

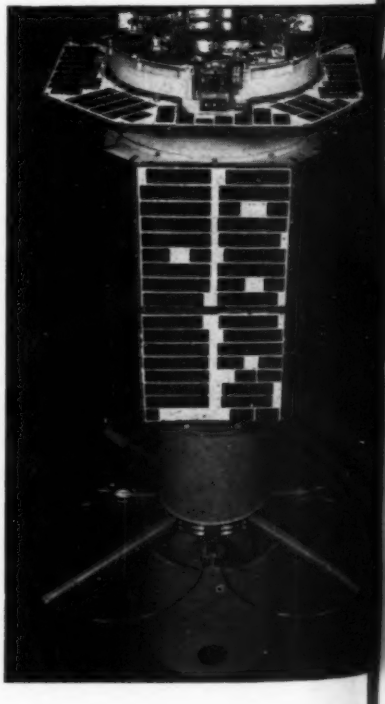
HMS *Girdle Ness*, the Royal Navy's Seaslug trials ship, returned to Devonport on April 26, after having been in the Mediterranean since July 1959. Operating from Malta, the ship has proved every part of the missile system of the Hampshire-class destroyers, and the Admiralty state, "The trials have shown the missile to be even better than hoped for, and the system of operation has proved a great success." Personnel training, and the evolution of optimum maintenance techniques, should ease the weapon's entry to service.

The Postmaster General has sought the advice of the Federation of British Industries on the "spread of industry" that should be consulted to ensure full co-ordination in the development of a communications satellite system, and he expects to arrange early talks with industry.

A Titan ICBM was fired for the first time from the bottom of the development silo for the Titan 2 family at Vandenberg on May 3. The silo is 146ft deep, and is almost certainly that damaged by an underground explosion of a Titan on December 4. The 98ft J-series missile left the silo cleanly, and was destroyed according to plan when 20 miles up and 40 miles out over the Pacific.

In a question in the Commons on April 25, Mr Airey Neave asked the Prime Minister if he would establish a Space Board or agency to further collaboration between Government Departments and industry on all matters relating to space research and technology. Mr Macmillan replied: "No. Under present arrangements full consultation and collaboration can take place, as necessary, between the Departments concerned and industry."

Explorer 11 gamma-ray astronomy satellite, successfully launched by NASA on April 27. Diameter of the box housing the telescope is 12in, and weight of the payload is 82lb (see "Explorer 11 Details")



Independent Opinion

HAROLD BAMBERG, Chairman and Managing Director of Cunard Eagle Airways, interviewed by FRANK BESWICK

WITH Air Transport Licensing Board hearings looming up which may well settle the issue of the independent airline operators' place on the main European and Atlantic routes, it seemed very well worth-while to put some background questions to the chairman and managing director of one of the key companies concerned. A little over a year ago I termed Mr Harold Bamberg "the independent independent"; but since that interview there have been changes.

For the record I first asked Mr Bamberg to recapitulate on the present position of the former Eagle enterprises. He explained that the Cunard Steamship Company now wholly own Cunard Eagle Holdings Ltd, and this organization in turn owns the three operating companies—Cunard Eagle Airways Ltd, Cunard Eagle (Bermuda) Ltd, and Cunard Eagle (Bahamas) Ltd.

What about the former maintenance company, which at one time was the subject of some controversy with the trade unions?

"All maintenance is now the responsibility of the operating companies, though we still do outside work. And since the unions have been mentioned I might say that these companies are fully associated with the National Joint Council machinery."

Under the new dispensation, is there any new strategy for your route pattern?

"We are thinking in terms of Europe, the Atlantic and the Caribbean as the three areas on which we shall concentrate. There is no political significance about this split; for the size of the job it is the best division for maximum efficiency."

Is this to be rigid division? I'm thinking of equipment utilization, for example.

"Not necessarily. Our airline crews, for example, might be deployed over the three companies, although that might not always be the case."

And where do you plan expansion—provided, of course, the ATLB is willing?

"Taking Europe first, we have 14 or 15 routes at the moment, fringe routes as we call them, which we have operated since 1953. It is quite clear to us, looking at that pattern, that we need to expand in order to provide proper utilization for the aircraft following on. But when we speak of the following-on aircraft, let me make the point that though there is an awful lot of talk about jets, we must not get too jet-conscious. For the domestic routes we need a comparatively slow, economic, unrefined aircraft."

New aircraft, or are you thinking of something retired from front-line work?

"No, a new machine. Something possibly with a fixed undercarriage and four reliable powerplants, a really *unrefined* aircraft; in this context the Vanguard might well be too refined and too fast. On our European pattern we should want more work for the type of aircraft we have in mind."

And if you are challenged as wanting only the heavy traffic—the plum routes—what would you say?

"We are not thinking only of routes parallel with the corporations; we are still interested in developing new ones. We have already spent a lot of money on development."

What about the Caribbean area? There seems to have been a good deal of activity around the Bahamas. What is actually happening?

"*Flight* for April 20 gave some details about our route from the Bahamas, but I would like to make it clear that we are not engaged in any rate war. The facts are that Bahamas Airways and ourselves were licensed to Miami about the same time—March last year—but on the clear understanding that Bahamas Airways ran a DC-3 service as an extension to their inter-island operation. We accepted that position with Pan American and ourselves operating the Miami route, and BA running this specialized service. But then BA put on Hermes, and at the $28 fare agreed for the DC-3s. We filed a $23 'early-bird' (before 8 a.m. flight), which we started last July. Since then the respective authorities have approved a fare of $33 for all operators, which, incidentally, is a reduction on the fare existing before we came on the route, which was $42. We are now carrying about 3,000 passengers a month, but we have spent £160,000 on development, and with Bahamas Airways proposing to put Viscounts on to the route something should be done. It is our belief that the Bahamas Government should look at the situation and establish, through licensing, the right kind of control."

If the Government assessed the situation in much the same way as the new board, you would accept their decision?

"Certainly."

Have you any other plans from the Bahamas—to the south, for example?

"We have the Lauderdale, West Palm Beach and Tampa foreign-carrier rights, and permission from the Bahamas Government for a service to Chicago. We have no other specific plans."

How about the Atlantic services?

"We are at present running a mid-Atlantic service through Bermuda to Miami, and quite extensive charters in the North Atlantic. Our main interest is to operate the North Atlantic scheduled services. These would be our top priority and would be the responsibility of the main London company.

"We have UK permission for cargo services and are now awaiting foreign-carrier rights from the USA. There is some little difficulty because Pan American want limits imposed, but I hope that the full rights will be obtained. We have studied the CL-44 for these cargo services; it is designed for the freight job, but our probable course of action will be to modify the Britannias—I think they will be better than the DC-7F for our purposes. In another four or five years we may well have new low-cost jet aircraft for freight carrying, but in the meantime the Britannia with the contemplated modifications should do our job very well.

"The two Boeing 707s would be for passenger operations, and I might add that we have an option on a third machine."

What about the services from Bermuda?

"We are now flying to New York, but we expect to run to Baltimore, Washington and Montreal. We previously had a service to Baltimore; it was suspended, but we shall go back."

Is this not all seasonal traffic?

"Yes, but it's a very long season of eight or nine months and we can get adequate utilization."

You say your main concern is with the North Atlantic: if you get a licence from the board do you visualize straight competition with BOAC?

"We have to look at this in a completely new way; it is said that we are to 'challenge' BOAC, and that there is to be 'a battle,' but I believe this to be the wrong terminology. The word 'spur' would probably be better. We hope to be a useful spur. Certainly we shall compete to some extent, but that is not the main issue."

What, then, is?

"Well, there is room for an additional British carrier to get more traffic for this country; BOAC is not the only other operator on the

(*Concluded on page 620*)

The 1961 Gliding Championships

By ANN WELCH

Lasham line-up at the last Nationals, held two years ago

"Flight" photograph

AT MID-DAY on Saturday next, May 13, the Minister of Aviation will declare open the 1961 National Gliding Championships at Lasham Gliding Centre, Hampshire. Flying will continue until Whit Monday, May 22, when prizes will be presented by Lord Brabazon. The Duke of Edinburgh is expected to visit the championships on Friday, May 19. During the first weekend of the contest (May 13-14), aircraft and equipment will be exhibited at the second International Glider Trade Fair to be held at Lasham. On this page the organization of the contest is described by Mrs Ann Welch, clerk of the course and chief task-setter; opposite the full entry list is given and some of the aircraft are detailed.

FOR the ten days between May 13 and May 22, Lasham becomes one of the most active airfields in the country. During this year's National Gliding Championships, weather permitting, there may be as many as 500 take-offs and landings a day by gliders and tugs taking part in the biggest championships yet.

The number of entries this year gave the organizers considerable embarrassment. It was known that the numbers were increasing, and months ago a warning was published that some sort of qualifying competition might well have to precede future Nationals. But this was not expected to be necessary this year, assuming the rate of increase of about 8 per cent which had remained steady for the last four contests (over eight years). Our expectations were frustrated, however, by a sudden jump in the entries of about 25 per cent. No fewer than 112 applications were received. After a great deal of difficulty this was reduced to 90, the maximum number we could handle. The only fair way to sort out much of League 2 was by ballot, and the unlucky ones were put on a waiting list in the balloted order.

The competitors are divided, as in previous years, into Leagues 1 and 2. League 1 contains the pundits, and will have tasks set each day which are intended to produce flying of world-championship standard. There will be 50 gliders in this league. The second group of 40 gliders will have tasks aimed at giving as much competition experience as possible, in addition to opportunities for obtaining gold and diamond distance flights.

The tasks, one of which will be set each day for each league, will be selected from the following:

(1) Free distance, in which the competitors try to obtain the greatest distance in the direction of their choice,
(2) Distance along a line set by the organizers, in which there is loss of marks for divergence from the line,
(3) Races, either straight to a set goal or to a turning point and return to Lasham, or round a triangular course and return.

The direction in which the gliders are sent and the length of the speed courses are, of course, dependent on our English weather, and very many fingers are being crossed for the belated spring anticyclone to turn up, with unstable north-easterlies. A modern glider flown by a competent pilot can make satisfactory progress against winds of 15kt provided that the thermals are good, but howling westerly gales straight towards London Airport would defeat the finest pilot and, if we have that sort of weather, very little flying will be possible.

The ideal conditions are those with a lightish wind of 8-10kt, and small cumulus at about 4,000-5,000ft. Then it is possible to return over the finishing line at Lasham at 50ft and 120 m.p.h.; while League 2 has, say, a clear run for the maximum distance they can achieve. The two leagues are thus separated, so reducing the risk of collision and making the best use of the weather.

All take-offs will be by aero-tow, and 20 tugs, ranging from Tiger Moths to Austers and Chipmunks, will be used. The take-off interval is 90sec but, in superb weather, when the competitors are desperate to get away, this can be reduced to 1min with stream take-offs. The gliders are towed to 2,000ft and released. If the task is a race, they must cross a starting line before setting off.

This year there are two changes in the contest rules. Until now there has only been one national champion—the winner of League 1. Now there will be two. Within League 1 there will be an open-class competition, and also a standard-class competition for gliders not exceeding 15m span. The league will be marked as one group, and a list will then be made of the standard-class marks. The winner of the championships will be, say, the open-class champion, and the pilot of the top 15-metre glider (provided that he has obtained 80 per cent of the winner's marks) will be the standard-class champion.

The other change is an important alteration to the marking system. Until now the maximum number of points available for each contest day has been the same—usually 1,000. This has meant that a poor-weather day in which only a small number of the competitors have been able to score—often because they were lucky in getting away in the only reasonable thermal of the day—has had the same value as a good day. This put an undesirably high premium on luck. With the new rule, the value of the day will vary according to the number of pilots who score. If 20 per cent or less score, the day will not count at all. If 60 per cent or more score the day will be worth 1,000 points. In between these figures the maximum points available will be in proportion. We hope that the new system will keep luck in its proper place.

This year, for the first time since 1947, a team from abroad has been invited to fly *hors concours*. Our guests will come from Poland, but unfortunately are unable to bring with them their fabulous Foka and will be flying a British Skylark 2 on loan from the Surrey Gliding Club. Also flying *hors concours* is Karl-Heinz Tiede, from Ghana, who will fly a German Ka-6.

The championships are organized and run by volunteers—gliding enthusiasts who give up their holidays to make a success of the event. They work extremely hard throughout the ten-day period, and why members of the launch-point team do not suffer from permanent fallen arches and the observers from spots before the eyes for ever after I can never understand. Not all the helpers are local; some come from other clubs, and a few are not glider pilots but nevertheless appear without fail at every championship. Altogether some 80 helpers, not counting the 300 who also devote their holiday to crewing for the pilots, are involved.

"Flight" photograph

SAILPLANES AT LASHAM

ONE new 15-metre type, several refinements of established British designs, and a few Polish and German machines are included in the sailplanes entered for this year's National Gliding Championships. As indicated by the full entry lists below, there are 50 aircraft in League 1 and 40 in League 2.

Thirty-two of the 50 League 1 entries are Slingsby Skylark 2s and 3s. These include a 3F "special" flown by ex-world champion Philip Wills, which has been fitted with modified ailerons of greater span and smaller chord. The new ailerons are said to produce a great improvement in rate of roll, and are to be introduced on production aircraft soon.

The selection of sailplanes from Elliotts of Newbury is a particularly interesting one this year, with the third example of the 15-metre Type 460 making its first appearance in national contest flying. First flown by David Ince on March 25 at Bicester, the new machine will be flown by Sgt Andy Gough of the RAF during the Lasham contest. Currently known as the Type 460 Series 1B, it will be officially named by Peter Scott during the championships.

The first two prototypes of the 460 suffered in performance because of airflow breakaway aft of the hood. In the third machine the canopy has been redesigned and lowered, and the pilot has a more reclined position. All three were flown at the recent RAF contest at Bicester, and the superiority of the third version was demonstrated. After final tests, the company hopes to build a production series at a price of £1,000.

The first prototype of the 460 has been modified to the standard of the third machine, and will be flown in League 1 of the championships by Flt Lt R. A. E. Dunn of the Empire Test Pilots' School. The second prototype is entered in League 2 and will be flown by Flt Lt Allen Loveland.

Four Olympia 419Xs and one Olympia 419 have been entered in League 1. The company plans to build one more 419X at a basic price of £2,150.

Other Newbury sailplanes in the championships include the 15-metre Olympia 401 and 403 machines.

Foreign gliders taking part comprise two Bocian two-seaters (one entered by the Polish Air Force Association Club at Lasham), one Jaskolka, two Ka-6s and a Ka-7.

Heading photograph on this page: Olympia 403 on Tiger Moth tow at the 1959 National Gliding Championships at Lasham

ENTRY LISTS FOR LEAGUE 1 (below) AND LEAGUE 2 (right)

No.	Entrant	Pilot	Aircraft
1	P. A. Wills	P. A. Wills	Skylark 3F
2	L. G. Kiloh*	I. Paul	Skylark 2
3	A. Coulson	A. Coulson	Skylark 3B
4	W. A. H. Kahn*	W. A. H. Kahn	Skylark 3B
7	J. V. Inglesby	J. V. Inglesby	Olympia 2
8	G. H. Stephenson	G. H. Stephenson	Skylark 3F
9	London GC	C. A. P. Ellis	Skylark 3
10	P. Scott	P. Scott	Olympia 419X
14	Bristol GC	A. O. Sutcliffe and D. W. Corrick	Olympia 2
16	RAFGSA	J. L. Bayley	Skylark 3B
18	G. Benson*	C. Green	Skylark 3F
19	Mrs A. Burns	Mrs A. Burns	Skylark 3B
20	D. R. Clayton*	D. D. Carrow	Skylark 3B
41	R. Rutherford	R. Rutherford	Skylark 2
42	D. A. Smith	D. A. Smith	Skylark 3
44	A. H. Warminger	A. H. Warminger	Olympia 419X
52	Army GA	E. G. Shephard	Skylark 3F
58	Army GA	D. J. Corbett and G. R. Hearsey	Eagle
60	D. M. Kaye*	D. M. Kaye	Eagle
65	Mrs R. Harwood*	Mrs R. Harwood, H. Mettam and H. McKinnon	Skylark 3B
66	F. G. Irving*	W. N. Tonkyn	Skylark 3F
67	Jill Walker*	G. E. Burton	Skylark 3B
68	R. T. Willbie*	R. T. Willbie and K. O'Riley	Skylark 3B
71	B. Thomas*	B. Thomas and J. Tweedy	Sky
72	Army GA	A. J. Deane-Drummond	Olympia 419
73	RAFGSA	F. D. Cretney	Skylark 3B
75	H. C. G. Bucking-ham	D. H. G. Ince	Olympia 419X
78	Bristol GC	P. E. Collier	Skylark 2
86	RAFGSA	J. Williamson	Olympia 419X
89	RAFGSA	G. Coatesworth	Olympia 401X
90	Elliotts of Newbury	A. D. Piggott	Olympia 403
91	A. Doughty*	A. Doughty	Jaskolka
97	F. A. O. Gaze	F. A. O. Gaze	Eagle
123	Surrey GC	J. Adamek and R. Zabiello**	Skylark 2
132	RAFGSA	N. W. Kearon	Skylark 3B
145	RAFGSA	A. N. Gough	Olympia 460
146	RAFGSA	J. Croshaw	Skylark 3F
148	Surrey GC	H. P. Hilditch and C. Wills	Skylark 2B
150	C. Sellick	R. A. Mann	Skylark 3F
155	H. R. Dimock	H. R. Dimock	Skylark 3F
160	B. J. James	B. J. James	Skylark 3F
161	C. W. Bentson	C. W. Bentson	Skylark 3F
167	J. R. Jeffries*	J. R. Jeffries	Weihe
168	D. C. Snodgrass	D. C. Snodgrass	Skylark 3F
174	Slingsby Sailplanes	F. G. Irving	Skylark 3F
175	P. G. Burgess	P. G. Burgess	Ka-6
176	K. H. Tiede	K. H. Tiede**	Ka-6
177	G. H. Nixon*	G. H. Nixon and M. C. Fairman	Skylark 3
180	J. D. Jones*	J. D. Jones	Skylark 3F
181	RAFGSA	R. Dunn	Olympia 460
189	Slingsby Sailplanes	A. J. Stone	Skylark 3F
190	Army GA	E. Stark	Skylark 3F

* Syndicate entry ** Hors concours

No.	Entrant	Pilot	Aircraft
11	A. T. Cole*	B. J. Davey	Eagle
12	Army GA	J. A. Evans and Sir Charles Dorman	Skylark 2
13	C. W. Mackworth-Young*	C. W. Mackworth-Young and E. F. R. Smith	Eagle
15	Imperial College GC	H. R. Browning and K. J. Bignell	Skylark 2
33	R. H. Perrott*	R. H. Perrot and G. F. Fisher	Skylark 2C
34	R. D. Dickson	R. D. Dickson	Gull 4
35	Surrey GC	M. I. Gee and J. Baker	Skylark 2
37	B. Thomas*	A. H. Baynes and K. W. Blake	Skylark 3B
40	T. A. McMullin	T. A. McMullin and R. C. Stafford-Allen	Olympia
43	W. R. Bradford*	M. C. Russell and W. R. Bradford	Petrel
45	RAFGSA	T. Ware	Skylark 3F
47	D. M. R. Riddell*	D. M. R. Riddell, M. Bird and M. J. Broad	Ka-7
48	A. N. Thaiwte	R. I. Tarver and J. A. Findon	Olympia
55	Cambridge University GC	J. S. Johnstone, G. Whitfield, D. Braham and A. Cruikshank	Eagle
63	Army GA	P. Goldney and F. W. L. Sheppard	Skylark 2
64	London GC	J. M. Hands and S. R. Dodd	Sky
70	H. N. Gregg	H. N. Gregg	Skylark 3B
74	RAFGSA	J. D. Spottiswood, J. Delafield, P. E. Dawson and C Taylor	Eagle
80	Crown Agents GC	J. E. G. Harwood	Swallow
81	D. W. Stowe*	D. W. Stowe, P. R. Philpot	Skylark 2
87	Fenland GC	G. Rondel and I. W. Strachan	Olympia 2B
95	J. C. Riddell*	J. C. Riddell and J. K. White	Skylark 3F
96	Imperial College GC	P. Minton	Eagle
99	K. A. Aldridge	K. A. Aldridge	Olympia 2B
103	G. T. Collins*	G. T. Collins and B. O. Warmington	Skylark 3
108	H. Greenway*	V. C. Carr and H. Greenway	Olympia
110	Army GA	J. H. Welsh and D. Macey	Olympia
113	RAFGSA	M. Bacon and E. W. Clarke	Olympia 2B
116	RAFGSA	A. Eldridge and J. W. Pickles	Olympia 2B
129	Coventry GC	M. S. Hunt, D. Cunningham, and P. Martin	Olympia
134	RAFGSA	J. R. Chandler and K. V. Newholme	Olympia 2B
144	RAFGSA	A. Loveland	Olympia 460
147	Surrey GC	D. C. Kerridge and A. D. Purnell	Skylark 3F
163	Northamptonshire GC	K. R. Pearson	Skylark 2
186	Polish AFAGC	T. J. Krzystek, E. Jerzycki, L. Kurylowicz and R. Zgorski	Bocian
187	Cambridge University GC	A. L. L. Alexander and G. S. Neumann	Skylark 3F
191	J. P. Mackenzie*	J. P. MacKenzie and B. Jefferson	Olympia 2B
195	Coventry GC	L. A. G. Glover	Viking I
196	RAEGC	J. Torode and R. Procter	Bocian
200	J. Fielden	J. Fielden and P. Berriman	Skylark 3

* Syndicate entry

INDEPENDENT OPINION (continued from page 617)

Atlantic—there are many others and a vast trade. With a daily frequency we would not take anything away from BOAC's existing traffic at all; but, if we get a share of the growth-factor—say 3 or 4 per cent of the new business—this would give us a profitable operation."

What is your attitude to pooling?

"I can only tell you that we are not convinced that it provides the right answer for the long term, though it may have a use in certain circumstances. Pooling for pooling's sake is a bad thing and you must have the right reasons in given cases. Over the North Atlantic there is a fairly strong case for *not* pooling."

Why?

"For one reason, because of the precedent already set by the American carriers. To some extent there is pooling, but it is not tied up as between, say, London and Amsterdam, or London and Paris."

You are prepared to take a risk, with aircraft costing over £1 million each, that you will get a share of the traffic?

"Yes. We are confident of our ability to achieve a decent load factor, not by poaching but by this share of growth traffic, which has amounted to an average of 19.9 per cent per year since 1950 and with a 24.7 per cent increase in 1960."

But surely the others, BOAC for example, have also taken this potential growth into account when ordering their new equipment?

"I don't think they have taken it sufficiently into account, and we hope to prove it. One example is that they have obviously had to change their plans: they have just bought another three Boeings because their original calculations were out."

How far do you apply these arguments on pooling to Europe?

"I think it is better for the board to go into all the factors involved rather than for one operator to start by saying that he is prepared to pool. It is, we believe, the board who should give judgments—it is not for any one operator, including BEA, to come out with a whole set of remarks which are bound to be biased as they are currently operating all the routes. It seems quite wrong for Lord Douglas to say he will *fight* the independents. That is not a sound policy."

Can you explain precisely why you think they should not explain their intentions?

"Because it is the board who will have to decide these things. A monopoly operator cannot take a stand like this when the issues are so important. They must be examined by an impartial board."

And what about pooling on the European routes?

"Again it is the board who must first make certain decisions about parallel operators, and then, if necessary, come back to the question of pooling."

You mean that the board should consider recommending a pooling arrangement as between one commercial concern and another?

"They may have to—if a new operator is to be licensed on a particular route it may be necessary for them to participate in an existing pool. Obviously, when traffic rights are dependent upon pooling, then this aspect cannot be ignored when licences are considered. I can conceive that what the board may say or do is to grant a route certificate on the understanding that it will be implemented under an existing bilateral agreement."

Do you not think that this readiness to go into a pool is really running counter to all the arguments for competition?

"I can only speak for my own company, and we are not quite so sensitive about competition. There is a lot to be said for it."

But what about competition as between independent companies? Is it not a case for coming to an agreement before putting in an application for a parallel route with the corporations?

"To my mind this problem with the competing independents will find its own level—it may be necessary in some cases to co-operate and in others to compete—all under the fatherly eye of the new board. But whether this should all be gone into beforehand is a new thought for us."

Just a word about the mechanics of the new hearings; do you intend being represented by Counsel, or do you think the legalistic approach can be taken too far?

"We do not intend to brief Counsel, nor do we think either applicants or objectors should stand too rigidly on legal points, or the whole object of the board will be frustrated. The air transport industry has its own identity and procedures, and the issue ought to be settled on the basis of air transport economics. There seems to me the danger that if any of the top-notch Counsel indulge in too much legal finesse some of the essential considerations will be overlooked."

* * *

Finally I asked Mr. Bamberg if, with his Cunard hat on, he would care to answer the question which is bound to be asked in Parliament: *How can a public subsidy for the Cunard Company be justified, if all this Atlantic traffic is going by air, and their money is being used to buy expensive aircraft?*

"There will always be," replied Mr Bamberg, "a considerable volume of sea traffic and we cannot be too certain about long-term fluctuations. It takes 25 years properly to amortize a big liner, and it is extremely difficult for Cunard, in the interests of their shareholders, to see a complete recovery on purely commercial grounds, particularly as other sea carriers are subsidized.

"Hence the need for Government assistance, but it is quite untrue to say that this assistance is being put into aircraft. The facts are that this assistance is directly related to the sea trade, and the Cunard Company regard their air interest as a new and important activity which is quite separate financially."

BAC IN AMERICA

AN American subsidiary, British Aircraft Corporation (USA) Inc, has been formed by British Aircraft Corporation. Its business is to promote sales of aircraft and guided weapons in the United States and its principal office will be at 399 Jefferson Davies Highway, Arlington, Va. The president is Mr Christopher Clarkson, AFC, who in recent years has been North American representative for Vickers-Armstrongs (Aircraft) Ltd; and Mr P. Murry White, vice-president of Vickers-Armstrongs Inc since 1959, is executive vice-president. Other directors are Mr E. L. Beverley and Mr A. H. C. Greenwood (vice-presidents) and Mr E. S. Dean. They are, respectively, sales manager (guided weapons) of BAC; chairman of the aircraft sales committee of BAC and sales director of Vickers-Armstrongs (Aircraft) Ltd; and US representative of English Electric. Mr F. C. Hydes is appointed director, technical sales.

With this announcement, British Aircraft Corporation have made known two new military sales appointments. One is of Air Chief Marshal Sir Hubert Patch, KCB, CBE, who becomes the corporation's representative responsible for NATO affairs; he will have an office in Paris and is to take up his duties shortly. The other is of AVM W. C. Sheen, CB, DSO, OBE, as director of military sales in the corporation's newly formed US subsidiary, an appointment he assumes on July 1. Air Chief Marshal Patch, who is retiring from the RAF this month, has been until recently chairman of the National Air Traffic Control Planning Group. Previously he was C-in-C British Forces Arabian Peninsula. AVM Sheen was Military Air Attaché at the British Embassy in Washington until his retirement from the RAF earlier this year. Prior to that (from March 1958 to January 1960) he commanded the RAF staff at the British Joint Services Mission in Washington.

ATS REORGANIZATION

CHANGES in the ATS Co Ltd are announced by Hawker Siddeley Aviation Ltd, the controlling company. There have been two elections to the board, and the concern—which collates, evaluates and distributes information to HSA companies—is to be reorganized on a more comprehensive basis.

The board appointments are of Air Cdre F. R. Banks, managing director of Blackburn Engines Ltd, and Mr P. G. Lucas, special assistant to Sir Aubrey Burke, chairman of de Havilland Aircraft Co Ltd. Air Cdre Banks is to take over as chairman from Mr S. D. Davies, technical director (aircraft) of Hawker Siddeley Aviation; he will continue as managing director of Blackburn Engines and Mr Davies remains a director of ATS. Mr Lucas will be responsible for Services liaison.

Future role of the ATS Co will be to provide HSA with a central information, evaluation, analysis and market assessment service in the aerospace field—covering all types of aircraft, powerplants, ballistic devices and orbital and space vehicles. It will also have a transport and economics department under Mr A. H. Stratford, built around a team formed and controlled by Sir W. G. Armstrong Whitworth Aircraft Ltd.

Mr M. N. Golovine is to continue as managing director, a post he took up over two years ago and in which he has expanded the scope and services of ATS; he was largely responsible for forming the Franco-British HSA/SEREB initiative group for study of West European aerospace industrial potential. Other board members are Mr J. T. Lidbury, chief executive, HSA; Mr J. A. R. Kay, sales director, HSA; and Mr J. C. Floyd, chief engineer, HSA advanced projects group. Company headquarters are to remain at present at 18 St James's Square, London SW1.

TWA SuperJet to all America

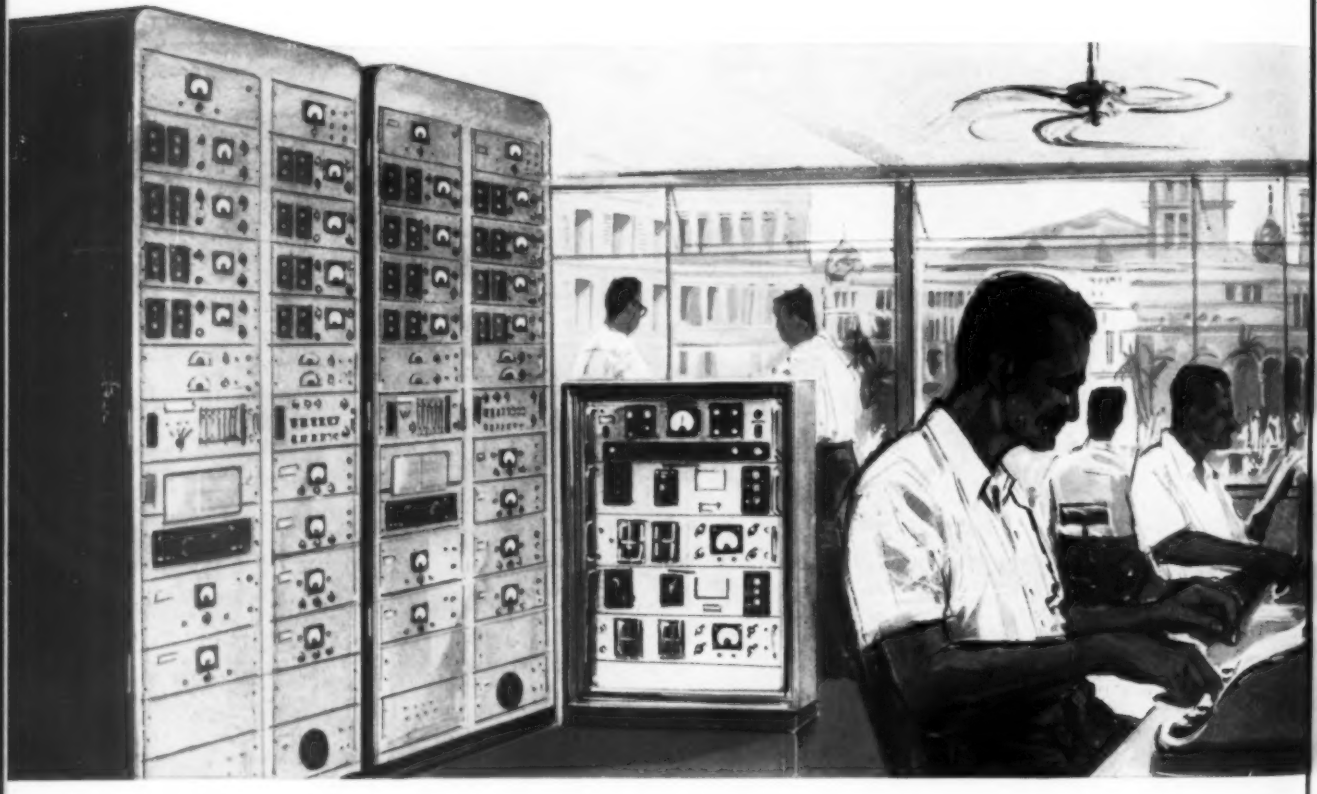
TWA, the SuperJet Airline, serves more than 70 major U.S. cities from 23 world centres. The airline, which pioneered over-weather flying in the thirties with an earlier Boeing, now carries more than 6 million passengers annually on its network of world routes from San Francisco throughout the U.S.A., Europe, Africa and the Orient. One of TWA's four main transatlantic routes serves Madrid, where—as at other stops on TWA routes—the 21,000 gallon tanks of the Boeing 707 Superjet are replenished by AIR BP in a matter of minutes.

Fast flying TWA... fast fuelling AIR BP

Plessey

TELECOMMUNICATIONS

speed weather forecasting



Plessey is everywhere, you'll find . . . in the Middle and Far East for example, where minute-by-minute plotting and data transmission are the only key to effective warning of adverse weather conditions.

The ubiquity of Plessey Radio Teleprinter Equipment is as complete in world meteorology, press and consular services as Plessey Telecommunications is in the total telecommunications field. A vital amenity for any civilised community, the accurate dissemination of weather data is essential to airways, to planned agriculture, and in many localities to the very preservation of life itself. It is a field of service in which Plessey is proud to be making a major contribution.

Behind this achievement are the extensive prototype and quality manufacturing resources of the Telecommunications Division, inspired by the work of a unique research and development organisation.

The Company recognises the need to segregate advanced thinking from the hustle and distraction of the factory. Accordingly, in addition to the Group Research Laboratories at Roke Manor and other specialised research centres already existing in the U.K., extremely well equipped laboratories have recently been established at West Leigh for advanced telecommunications studies.

It is in these establishments that the next generation of telecommunications equipment is already taking shape.

In close support at all times are the complete resources of the Plessey Group of Companies which include unrivalled tool making and machining facilities, a full range of environmental testing and production laboratories, and the services of the materials laboratories at Caswell.

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TD6

INTERNATIONAL SURVEY

VTOL

A "Flight" Review of Principal Aircraft

GREAT BRITAIN

Hawker Aircraft Ltd

Kingston-on-Thames, Surrey

P.1127 Revolutionary though the P.1127 is, it is no mere research vehicle but the prototype of an S/VTOL strike reconnaissance aircraft. It uses a single lift-thrust engine—the Bristol Siddeley BS.53—for both vertical take-off and forward flight, this being achieved by using four swivelling nozzles to direct the thrust downwards and then gradually turn the thrust to the rear for forward flight. The history of the project was told in some detail in *Flight* of December 2, 1960. Only meagre technical details have so far been released, but on that occasion it was remarked: "Hovering control is exercised by bleed-air jets at the extremities of the body and wings. There must be an auto-stabilization system, and probably a programme control will be evolved for rotation of the main-engine nozzles in order to achieve the optimum transition from jet-lift to wing-supported flight, and *vice versa*. Jet-lift aeroplanes can have relatively small wings. Nevertheless the P.1127 must be designed for deadstick approaches with rudder, ailerons, slab tail, wing flaps and probably a drag chute and brakes on both fore and aft undercarriage units. Flight profiles must also be so chosen as to minimize the dangerous combination of engine failure at low altitude and low forward speed."

The first flight as a normal aircraft took place on March 13, and the aircraft is now well into its free-flight programme. On the early flights the propulsive nozzles are being kept facing rearwards at all times, but when basic handling is being investigated they will be rotated to produce increasing increments of lift until jet thrust is sufficient to support the aircraft without assistance from the wing.

● Span, 24ft 4in; length, 41ft 2in; height, 10ft 3in; tailplane span, 10ft.

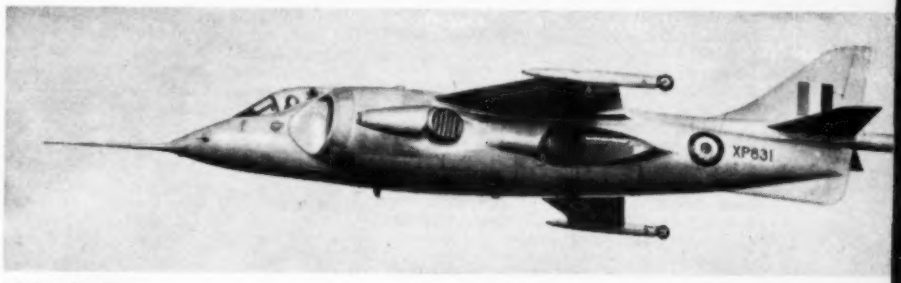
Short Brothers & Harland Ltd

Queen's Island, Belfast

SC.1 The characteristics of this historic VTOL research aircraft are now generally known, having been described in several papers and in a detailed article appearing in *Flight* of June 10, 1960. Delta-winged, the aircraft is powered with five Rolls-Royce RB.108 turbojets each of 2,130lb thrust. Four of these act as lift engines and the fifth is for propulsion.

The achievements of the SC.1 have recently been summarized by one of the makers' deputy managing directors in the following terms: "The objective behind the development of the SC.1 can be stated simply as one of demonstrating that transitions from hovering to conventional flight and back to hovering can be carried out safely. This has been achieved, and thus the essential part of the task is complete. Much remains, of course, to be done in refining the techniques. In the course of reaching our present state the following main problems have been studied: (a) Flight development of the Rolls-Royce RB.108 lifting engines—their handling in flight, engine starting and intake design. (It is inevitable that the powerplant and airframe are developed simultaneously.) (b) The development of a satisfactory autostabilizing system with a proper degree of reliability. This has meant many hours running on a full-scale dynamic rig, 20 hours or so of aircraft hovering in a gantry, and free flight trials. (c) The development of suitable ground equipment, test gantries and platforms—essential for development work, but not necessarily for operational use. (d) Associated with platform development, study of ground suction, recirculation of exhaust gases, and soil erosion. (e) Flight development in the hands of several pilots, including take-offs carried out on conventional runways after a short ground roll and finally jump take-offs from conventional runways with no ground roll and no platform. As a direct result of the SC.1 and many project studies, and I may say having had the advantage of making many mistakes, we obviously know something of the specialized aerodynamic problems, and particularly about weights—design areas likely to make or break a VTO aircraft."

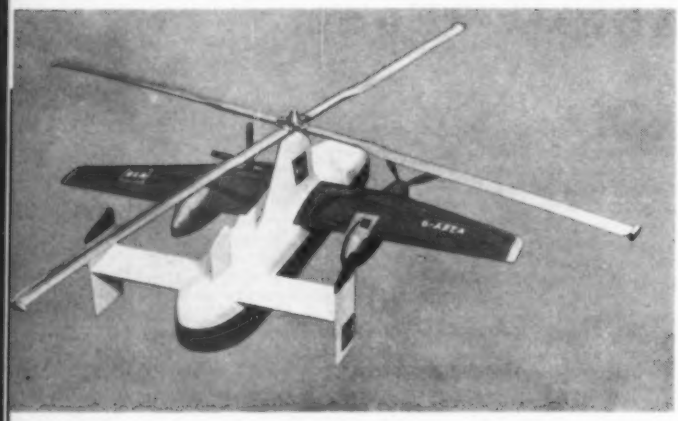
● Span, 23ft 6in; length (over nose probe), 29ft 10in; height, 10ft 8in.



Hawker P.1127

Short SC.1

Westland Rotodyne "Y"



Westland Rotodyne (model of production version)

VTOL

INTERNATIONAL SURVEY

Westland Aircraft Ltd

Yeovil, Somerset

Rotodyne The version of this VTOL airliner which is now undergoing development is called the Rotodyne "Y" and is powered by two Napier Elands. In recent months several alterations have been made, including the addition of a central fin—making three—and a rotorhead fairing. Design of a much larger version, powered by Rolls-Royce Tynes of 5,250s.h.p. and capable of carrying 65 passengers or 18,000lb of military equipment, is going forward. This is shown in model form in a photograph and numerous differences from the Rotodyne "Y" will be noted. The span has been extended by 18½ft to 75ft, and the fuselage is 4ft longer. Tip-jets, cockpit canopy and fins and rudders have been redesigned.

It is well known that one of the factors which could militate against the wide employment of the Rotodyne as a public transport vehicle is that of noise. In this connection the makers say: "The Rotodyne will make an unusual noise, but it will not be exceptionally loud or unpleasant and it is likely that the public will get used to it and gradually accept it as part of the general background noise experienced in cities today. The number of people subjected to the 95db noise level will be very small indeed, because heliports are likely to be situated either at roof-top level or on some relatively open space to provide reasonable approach paths. The Rotodyne's high performance, which allows it to climb and accelerate very quickly, means that although the tip-jets are alight for some 90sec per take-off, only small areas on the ground are affected and those only for a few seconds."

● Rotor diam, 109ft; length, 69ft 5in; overall height, 27ft 3in; gross weight, 60,000lb; cruising speed, 200-230 m.p.h.; max range 575 n.m.; vertical rate of climb at s.l., 2,150ft/min.

Westminster Two prototypes of this large helicopter have been built, but flight development is not at present in progress. The engines are two Napier Eland E.229A fixed-shaft rear-drive turbines each developing 2,650 s.h.p. The following figures apply to a flying crane version:—

● Rotor diam, 72 ft; overall length, 89ft 3in; basic weight, 21,345lb; gross weight, 33,000lb; max cruising speed, 149 m.p.h.; hovering ceiling out of ground effect, 9,000ft; max range (standard tankage), 200 n.m.

Belvedere Powered by two Napier Gazelle NGa.2 free turbine engines of 1,650 s.h.p. each, the twin-rotor Belvedere is in production for the RAF. Its prescribed roles are: troop transport, carrying up to 19 fully equipped troops; freighter, carrying up to 6,000lb either internally or externally; casualty evacuation, carrying up to 12 stretchers internally, a medical attendant and two sitting wounded; paratrooping and supply dropping; air/sea and mountain rescue, using an electrically driven winch capable of lifting 600lb (up to 18 people can be rescued in one sortie); armed or unarmed reconnaissance; anti-submarine defence; mine-sweeping; aerial tug; aerial crane.

Full dual control is standard on the Belvedere and autopilot and auto-stabilizer equipment can be fitted if required. The aircraft is fully equipped for night flying. Transmission design allows both rotors to be driven by either engine should the other fail. In this event the changeover to single-engine operation is completely automatic and takes only two seconds. The makers claim that the single-engine performance is such that the aircraft is able to return to base and make a normal landing in complete safety, whatever its all-up weight. They also make a particular claim for good performance in high temperatures and at high altitudes.

Westland Westminster

● Rotor diam, 48ft 11in; length, 89ft 9in; height, 17ft 3in; gross weight, 19,000lb; empty weight, 11,530lb; max econ. cruising speed, 138 m.p.h.; rate of climb at s.l. (at forward speed of 69 m.p.h.) 1,000ft/min; hovering ceiling out ground effect, 6,000ft; max range (standard tankage), 400 n.m.

192C A development of the Belvedere for use as a 23-passenger inter-city airliner or as a 26-seater troop carrier, the 192C will have greater fuselage capacity.

● Empty weight, 11,922lb; gross weight, 19,700lb; max economical cruising speed, 138 m.p.h.; max rate of climb (at best climbing speed of 80 m.p.h.), 1,250ft/min; operational ceiling, 10,000ft; max range (standard tankage and 20 min reserve), 410 n.m.

Wessex 1 Like the Belvedere, the Wessex uses the Napier Gazelle free turbine, but one instead of two, and that of the NGa.13

Westland Belvedere

series. Substantial numbers of an anti-submarine version are on order for the Royal Navy and are already entering service. The proving of the type in service was the subject of an article in *Flight* of November 11, 1960. On that occasion it was reported that the aircraft carried UHF and HF radio, "dunking" Sonar, radio altimeter, and Ryan APN-97A Doppler. Its anti-submarine weapons are carried externally, and the 1N anti-submarine system which is being fitted is licence-manufactured in this country by Louis Newmark Ltd.

The manufacturers list the roles of the Wessex as: 12-seat civil passenger transport; troop transport, carrying up to 16 fully equipped troops; casualty evacuation, carrying eight stretchers internally and a medical attendant; air/sea rescue, using an hydraulic winch capable of lifting 600lb; freighter, carrying up to 4,000lb in the cabin or in an internal freight sling; pilot training (full dual control can be fitted); anti-submarine defence (search *and* strike); para-trooping; aerial tug; aerial crane.

● Rotor diam, 56ft; length, 65ft 9in; height, 14ft 3in; gross weight, 12,600lb; empty weight, 7,600lb; max speed, 132 m.p.h.; max cruising speed, 126 m.p.h.; rate of climb at s.l. (forward speed 69 m.p.h.) 1,750ft/min; hovering ceiling out of ground effect, 5,000ft; max range (standard tankage), 340 n.m.

Wessex 2 This development of the Wessex 1 is a more powerful version, having two de Havilland Gnome free turbines of 1,250 s.h.p. each. Designed for both military and civil applications, it will have a performance in high temperatures and at high altitudes that will enable it to be operated, say the makers, "with realistic payloads in almost any part of the world." They add that its excellent single-engine performance will give it a high degree of safety for bad weather flying and city-centre operations. The following performance figures are provisional:—

● Rotor diam, 56ft; length, 65ft 9in; basic weight, 7,850lb; gross weight, 13,500lb; max speed, 138 m.p.h.; max cruising speed, 132 m.p.h.; rate of climb at s.l. (forward speed of 69 m.p.h.), 1,540ft/min; hovering ceiling in ground effect, 14,200ft; max range (standard tankage), 300 n.m.

Whirlwind The Whirlwind is offered with either the Alvis Leonides Major of 750 h.p. or Pratt & Whitney R-1340 of 600 h.p. Typically an eight-seater, with a crew of two, it has proved over the years its adaptability for numerous civil and military applications.

● Rotor diam, 53ft; overall length, 62ft; basic weight, 5,375lb; gross weight, 8,000lb; max cruising speed, 92 m.p.h.; hovering ceiling out of ground effect, 4,000ft; max range (standard tankage), 290 n.m.

Gnome Whirlwind This 8/10-seater general-purpose helicopter is powered by a 1,050

Westland 192C interior

Westland Wessex 1

Westland Wessex 2 (model)

Westland Gnome Whirlwind

Westland Whirlwind

Westland Scout

VTOL
INTERNATIONAL SURVEY

Westland Sycamore

Westland Skeeter

s.h.p. de Havilland Gnome free turbine engine. The makers point out that it combines turbine power with the important advantages of a rotor head and transmission system already proved in an earlier aircraft. Disposable load has increased by reason of the lower installed weight of the turbine and to the elimination of the clutch. The engine installation features an automatic control which varies power output to maintain a selected rotor r.p.m. irrespective of the collective-pitch setting. Conversion of earlier Whirlwinds to turbine power can be undertaken at the makers' Yeovil works.

● Rotor diam, 53ft; overall length, 62ft 4in; basic weight, 4,694lb; gross weight, 8,000lb; max cruising speed, 103 m.p.h.; hovering ceiling in ground effect, 15,800ft; max range (standard fuel), 275 n.m.

Scout (P.531) The makers' particular claim for this 5/6-seat multi-purpose helicopter is that it combines small dimensions, excellent payload/performance characteristics, good manœuvrability and operational versatility. It is fully equipped for day or night operation "in most weather conditions." The engine is a Blackburn Nimbus free turbine of 885 s.h.p., de-rated to enable sea-level performance to be maintained under all normal operating conditions of altitude and temperature. Particular attention has been paid to the accessibility of engine, controls and equipment.

The Scout is being supplied to the British Army and has completed evaluation trials with the Royal Navy. The makers list the roles as civil or military passenger transport; civil or military freighter, carrying up to 1,500lb internally or externally; battle surveillance; armed and unarmed reconnaissance; casualty evacuation, carrying two stretchers internally, plus a medical attendant; air/sea and mountain rescue (up to three persons can be rescued in one sortie, using a hoist capable of lifting two persons together); weapon carrier (land or ship-based); pilot training (full dual control can be fitted); and photographic survey.

● Rotor diam, 32ft 3in; length, 40ft 2in height, 10ft 11in; gross weight, 5,000lb; empty weight, 2,993lb; max speed, 138 m.p.h.; cruising speed, 132 m.p.h.; max rate of climb (at best climbing speed of 57 m.p.h.), 2,000ft/min; hovering ceiling in ground effect, 17,000ft; max range (carrying pilot and three passengers) 280 n.m.

Sycamore Powered with an Alvis Leonides piston engine of 520 h.p., the Sycamore has proved a notably successful general-purpose helicopter since it began operations in 1949. Current data follow:—

● Rotor diam, 48ft 7in; overall length, 61ft 1in; basic weight, 3,986lb; gross weight, 5,600lb; max cruising speed, 115 m.p.h.; hovering ceiling out of ground effect, 3,000ft; max range (standard fuel), 230 n.m.

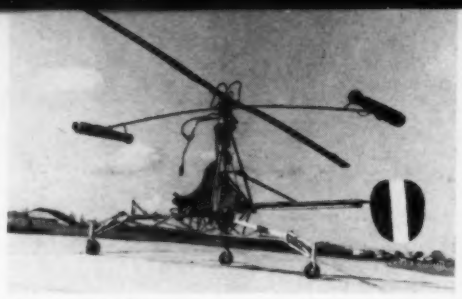
Widgeon This derivative of the earlier Dragonfly has a single Alvis Leonides piston engine of 515 h.p. A five-seater, it has wide civil and military applications and is especially suitable for executive transport.

● Rotor diam, 49ft 2in; overall length, 57ft 8in; basic weight, 4,322lb; gross weight, 5,900lb; max cruising speed, 101 m.p.h.; hovering ceiling out of ground effect, 4,080ft; max range (standard tankage), 260 n.m.

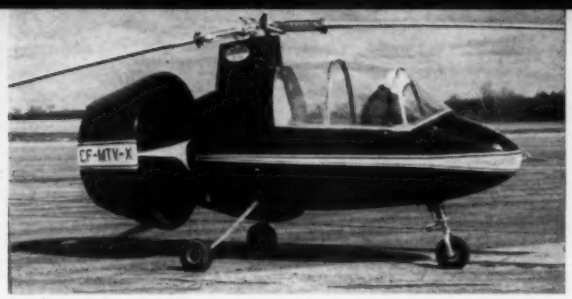
Skeeter Powered with a de Havilland Gipsy Major 215 piston engine, the Skeeter is a two-seater fitted with full dual control as standard. The engine is mounted transversely behind the cabin, the rotor drive being taken from the end of the crankshaft on the starboard side. Cooling is by a belt-driven fan. The port seat may be reversed for observation purposes or may be removed for the carriage of freight.

● Rotor diam, 32ft; length, 38ft 10in; basic weight, 1,638lb; gross weight, 2,350lb; max cruising speed, 101 m.p.h.; hovering ceiling in ground effect, 5,500ft; max range (standard tankage), 185 n.m.

Westland Widgeon



Baumgartl PB-64



Avian 2-180 Gyroplane

BRAZIL

Paul Baumgartl

Rua Lopes de Oliveira, 160, Sao Paulo

PB-64 An ultra-light helicopter powered by two pulse-jets mounted on the tips of the wooden (Alclad-covered) blades, the PB-64 has a controllable stainless-steel rudder located at the end of a tubular tail boom. There is a low-pressure main fuel tank and a high-pressure auxiliary tank for starting.

● Rotor diam, 21ft; length, 15ft; weight empty, 240lb; weight loaded, 500lb; max speed, 80 m.p.h.

Centro Tecnico de Aeronautica

Sao Jose dos Campos, Sao Paulo

Beija-Flor Designed and built to the initial design of Professor Heinrich Focke, this two-seat helicopter has a forward-located Continental E225 engine driving main and tail rotors through a centrifugal clutch and a David Brown lorry worm and wheel.

● Rotor diam, 29ft 6in; overall length, 27ft 8in; gross weight, 2,090lb; max speed, 93 m.p.h.; economical cruising speed 81 m.p.h.; max rate of climb, 1,220ft/min; hovering ceiling out of ground effect, 4,600ft; range, 169 miles.

Beija-Flor

CANADA

Avian Industries Ltd

Georgetown, Ontario

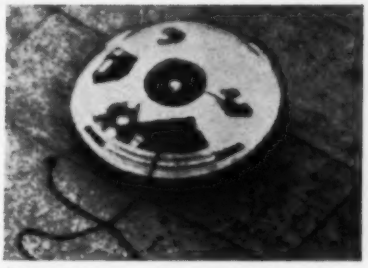
Gyroplane 2-180 The makers state that since *Flight's* "Helicopters of the World 1960" special issue of a year ago certain changes have been made in the Avian Gyroplane. The blades are now conventionally controlled and at present the rotor is mechanically driven from the engine by a belt and gearbox arrangement. It is claimed that the 2-180 will be safer and simpler to handle than conventional aircraft and helicopters. It has jump-start ability for vertical take-off, can fly at very low forward speeds without stalling or spinning, and may be landed safely with engine out. The ducted fan at the rear is driven by a Lycoming O-360-A engine of 180 h.p. Large removable panels allow the engine to be completely exposed and the instrument panel can be reached from behind. The undercarriage struts are designed for maximum interchangeability with minimum effort. At present a two-seater, the Gyroplane may eventually be offered with three seats, and for this version a cost per seat mile of 2 cents is foreseen.

● Rotor diam, 33ft; overall length, 16ft 2in; empty weight, 1,090lb; gross weight, 1,720lb; cruising speed, 130 m.p.h.; still-air range, 480 miles.

Avro Aircraft Ltd

Malton, Ontario

Avrocar Known to the US Army, which Service is sponsoring development, as the VZ-9V, this is a flat-rising vehicle having three Continental J69 gas turbine engines. There is a central fan which provides a ground cushion effect, and for forward flight the shape of the body is such as to provide aerodynamic lift. Details have not been released.



Avrocar

CZECHOSLOVAKIA

Omnipol Ltd

Washingtonova 11, Prague

HC-3 Announced since our previous review, this five-seater which is now under development for the Czechoslovak Army and for export. The engine is an M.108-8 of 240 h.p. and the machine is of notably clean design.

● Rotor diam, 38ft; length, 32ft 9in; gross weight, over 3,000lb; max speed, 100 m.p.h. approx.

HC-2 Heli-Baby Production models of this aircraft are intended to have an engine of 105 h.p. The makers claim particularly low operating costs, sturdy construction and sensitive and responsive control, and these characteristics are considered to render the aircraft suitable for training as well as for a wide range of utility applications. The standard undercarriage consists of main- and nosewheels and the engine is mounted behind the cabin, with its crankshaft inclined to the vertical. A metal monocoque boom carries the tail-rotor transmission, rail rotor, trimming surface and tail bumper. In one hour the Heli-Baby can carry a pilot and 220lb of payload over 62 miles, using only 4.85gal of fuel.

● Rotor diam, 28ft 11in; length, 34ft 5in; empty weight, 840lb; gross weight, 1,280lb; hovering ceiling, with ground effect, 3,600ft; rate of climb, 710ft/min; max speed, 78 m.p.h.; cruising speed, 62 m.p.h.; range, 93 miles.

HC-2

HC-3

Sud Alouette III

Sud Alouette II

Sud Djinn

Sud Frelon prototype

VTOL INTERNATIONAL SURVEY...

FRANCE

Sud Aviation

37 Bd de Montmorency, Paris 16e

Alouette II One of the most successful helicopters yet produced, the Alouette II is powered with a Turboméca Artouste 2 shaft turbine of 400 s.h.p. It is characterized by a glazed cabin and an unfaired steel tube rear fuselage. Typically a five-seater, it accommodates pilot and a passenger side-by-side, and three passengers at the rear. Two stretcher cases can be taken in the ambulance role in addition to two sitting patients and a medical attendant. A notable feature introduced on this aircraft is the automatic engine r.p.m. governing system designed to simplify piloting.

● Rotor diam, 33ft 6in; fuselage length, 31ft 10in; gross weight, 3,300lb; cruising speed, 106 m.p.h.; hovering ceiling (free air), 6,500ft; range, 290 n.m.

Alouette III A derivative of the Alouette II, this version differs from the earlier machine in having a slightly reinforced transmission system and in being powered with an Artouste 3B, a development of the Artouste 2, with more reserve power. Equipment and general layout are improved and the whole airframe has been cleaned up; particularly noticeable is the semi-monocoque tail boom. Two baggage holds are provided in the centre portion, on either side of the welded structure and enclosed by fairings. The cabin seats three at the front and there is a four-place folding seat at the rear. Two stretchers can be accommodated athwartships in the rear cabin. There are four doors.

● Rotor diam, 36ft 1in; overall length (blades folded), 33ft 1in; weight empty, 2,300lb; normal gross weight, 4,190lb; max gross weight, 4,630lb; cruising speed, 111 m.p.h.; hovering ceiling (free air), 13,100ft; range, 300 n.m.

Djinn Powered with a Turboméca Palouste turbine air-generator, the two-seat Djinn continues in production.

● Rotor diam, 36ft; fuselage length, 17ft 5in; gross weight, 1,676lb; cruising speed, 62 m.p.h.; hovering ceiling in ground effect, 3,000ft; service ceiling, 10,000ft; max range, 110 miles.

Frelon A production version of this large helicopter is reported to have a six-blade rotor and flying-boat hull. Like the prototypes it will be powered by three Turboméca Turmos. A full-scale mock-up is expected to be at the Paris Salon.

GERMANY W

Bölkow-Entwicklungen KG

Ottobrunn bei Munchen

Bo 102 Heli-Trainer Of the Heli-Trainer the makers remark: "It is the object of the Heli-Trainer Bo 102 to assure an absolutely safe and pedagogically consistent basic training for helicopter students at low cost. Experienced rotorplane experts have developed and constructed the Heli-Trainer, have subjected it to endurance tests, and have thoroughly tried it out in helicopter training centres. The principal element of the training apparatus is a single-rotor, single-seater helicopter which can both turn and change its altitude when mounted on a revolving ground support. All manœuvres of a flying helicopter can be practised with the float-mounted trainer. Elastic stops prevent any damage, even when the controls are fully and quickly actuated. On the water an air-filled stabilizer ring limits the inclinations by the longitudinal and transverse axes.

ITALY

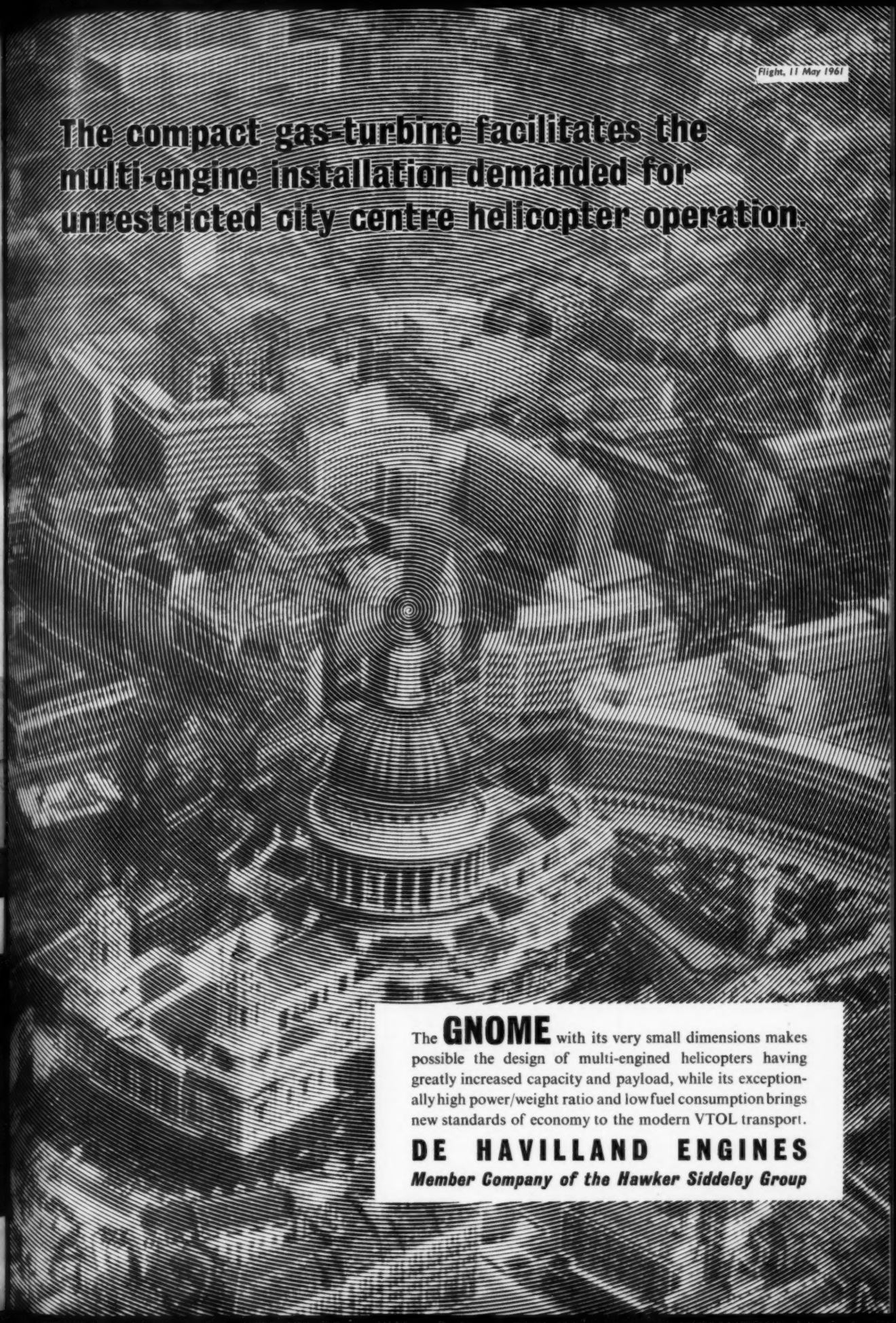
Aero Lualdi & C

Via Panama 95, Rome

L.59 The L.59 is the latest of a series of Lualdi light helicopters and has a rotor of the type fitted to the Hiller UH-12E, with a Lualdi gyro-stabilizer. Construction is all metal and the engine is a Continental IO-470-D of 260 h.p. The four seats are arranged in two pairs, with dual controls for the front pair. There are car-type doors on each side and provision is made for carrying two stretchers. (Data on next page.)

Bölkow Bo 102

Agusta 104



The compact gas-turbine facilitates the multi-engine installation demanded for unrestricted city centre helicopter operation.

The **GNOME** with its very small dimensions makes possible the design of multi-engined helicopters having greatly increased capacity and payload, while its exceptionally high power/weight ratio and low fuel consumption brings new standards of economy to the modern VTOL transport.

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VTOL INTERNATIONAL SURVEY...

● Rotor diam, 34ft 9¼in; fuselage length, 29ft 9¼in; weight empty, 1,701lb; gross weight, 2,667lb; max speed, 99 m.p.h.; cruising speed, 86 m.p.h.; rate of climb at s.l., 820ft/min; hovering ceiling in ground effect, 9,515ft; absolute ceiling, 19,355ft; endurance, 3hr.

Societa Per Azioni Fiat

Corso Giovanni Agnelli 200, Turin

Model 7002 Now undergoing trials, this aircraft will be seen from the photograph to be of unconventional layout. The two-blade main rotor is driven by cold jets, compressed air being supplied by a Fiat 4700 turbo-generator in which the turbine-driven air-compressor is operated by a hot-gas generator, or primary engine, that embodies almost completely the components of the Fiat 4002 turbojet. Although, in the absence of torque reaction, it would have been possible to abolish the tail rotor, it was in fact decided to install a small ducted rotor, mechanically driven by the main rotor, for directional control. This ensures maximum manœuvrability at low forward speeds and in autorotation. The fuselage is made up of light-alloy sheets and embodies very large transparent panels. A typical layout will provide for one pilot and six passengers.

● Rotor diam, 39ft 4in; fuselage length, 20ft; empty weight, 1,320lb; gross weight, 3,085lb; cruising speed, 84 m.p.h.; service ceiling, 11,150ft.

Costruzioni Aeronautiche Giovanni Agusta

Cascina Costa, Gallarate

Bell 47 Series In addition to the Bell 47G-2 and G-3, Agusta are offering the Agusta Bell 47J-3, under the designation Super Ranger. This seats four passengers on a single bench-type seat, in addition to the pilot. The engine is a Lycoming VO-540.

A-104 Helicar A side-by-side two-seater, the Helicar can be assembled or taken apart by one person. The engine is an Agusta A-140V of 140 h.p. and the rotor is two-bladed.

● Rotor diam, 26ft 1in; fuselage length, 20ft 10in; weight empty, 838lb; gross weight, 1,411lb; max speed, 103 m.p.h.; cruising speed, 84 m.p.h.; max rate of climb at s.l., 810ft/min; hovering ceiling in ground effect, 9,840ft; max range, 205 miles.

Model 102 This Agusta-designed helicopter uses a Bell type rotor and has a Pratt & Whitney R-1340 engine of 600 h.p. For stage-lengths of up to 62 miles—which, the makers say, represent the most frequent case for regularly scheduled passenger lines, tourist services, etc.—it will carry nine passengers plus 250lb of baggage or equipment. The supercharged engine permits cargo transport to be undertaken at altitudes up to 11,500ft.

● Rotor diam, 47ft 7in; fuselage length, 41ft 9in; empty weight, 4,000lb; gross weight, 6,280lb; max speed, 121 m.p.h.; cruising speed for best range, 100 m.p.h.; service ceiling, 14,000ft; hovering ceiling in ground effect, 9,500ft; max endurance 3hr 20min.

Model 204B This aircraft differs from its American counterpart (Bell Iroquois) in having a de Havilland Gnome. Agusta remark: "The Gnome has been specially designed to give ease of maintenance, and operators will also have the facility of extensive in-service component replacement schemes. These, together with the considerable development background of the engine, ensures a very high overhaul life for the Gnome. This is also assisted by the reduced operating conditions of the Gnome in the 204B resulting from the need to restrict the engine output to the power requirements of the rotor system. Further advantage is taken by utilizing this reserve of power for enhanced operation of the 204B at altitude and in hot weather condition."

● Gross weight, 8,508lb; max speed, 133 m.p.h.; range, 234 miles.

AZ-101G A prototype of this 30-passenger helicopter has been ordered by the Italian Air Force. This will be powered by three de Havilland Gnomes, rated at 1,050 h.p. for take-off. The main and tail rotors are four-bladed and the undercarriage is four-wheeled, the rear wheels being provided with brakes and the front wheels with shimmy dampers. There is a rear loading ramp which may be kept open in flight to permit the dropping of parachutists. Several versions, including one for anti-submarine operations, are in prospect.

● Rotor diam, 64ft; fuselage length, 54ft 1in; empty weight, 12,566lb; gross weight, 24,030lb; max speed at max cont power, 143 m.p.h.; cruising speed for max range, 125 m.p.h.; rate of climb (max cont power), 1,280ft/min; hovering ceiling in ground effect, 9,840ft.

NETHERLANDS

Nederlandse Helicopter Industrie N.V.

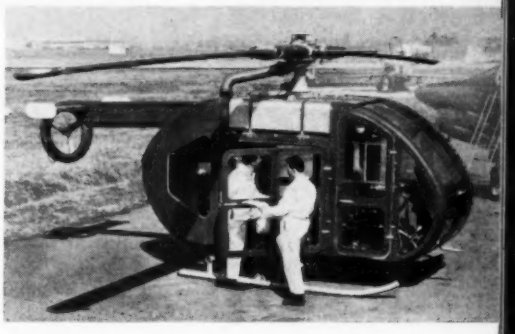
Veerdam 44, Papendrecht

NHI H-3 Kolibrie Designed for extreme simplicity, the Kolibrie is propelled by ramjets—one, of 44lb thrust, on each of the two blade tips. This helicopter has been developed with a particular eye to its use for agricultural purposes, and in this connection the makers have developed what they call a "helicar." They state: "It is uneconomical to fly the helicopter on non-productive flights since road transport is many times cheaper. It is possible to apply this method of transport to the Kolibrie by using a special trailer. The NHI has developed a 'helicar,' that fully meets the requirements. This helicar can be used as a landing platform, because of its large and flat loading-floor, which is equipped with foldable side flaps. The low total height of trailer plus helicopter makes it possible to pass normal viaducts, power lines, etc. The most important equipment is the special construction to support the rotor blades with mounted engines during transport."

The following performance data apply to a gross weight of 1,540lb, for which the aircraft is not at present certificated.

● Rotor diam, 32ft 8in; empty weight, 550lb; max speed, 68 m.p.h.; cruising speed (max endurance), 35 m.p.h.; rate of climb (at 35 m.p.h. air speed), 680ft/min.

Agusta Bell AZ-101G



Fiat 7002

NHI N-3

Lualdi L.59

Mi-1 Moskvich

Mi-4

VTOL INTERNATIONAL SURVEY

POLAND

Motoimport

Przemyslowa 26, Warsaw

SM-1 Essentially similar to the Soviet-built version, this Polish Mi-1 as offered by Motoimport can be equipped for agricultural, ambulance or executive work. The four-seat executive version has an enlarged forward fuselage. A fluid de-icing system is provided for the rotors and the windscreen can also be de-iced by fluid spread over the glass by the wiper. Engine oil may be diluted to facilitate starting in extreme cold. The inside of the windscreen can also be heated by hot air. De-icing fluid is contained in a 6 Imp gal tank with a secondary supply in a tank holding 0.6 Imp gal.

● Rotor diam, 47ft; length, 40ft 9in; empty weight, 3,925lb; gross weight, 4,960lb; max speed at s.l., 124 m.p.h.; max vertical rate of climb, 1,280ft/min; hovering ceiling, 9,840ft; max range at 87 m.p.h., 240 miles.

USSR

Kamov

Ka-15 A two-seat utility helicopter, the Ka-15 has two contra-rotating co-axial three-blade rotors driven by an AI-14V engine of 275 h.p. Most of the structure is metal, with metal and plywood covering.

● Rotor diam, 32ft 8in; cruising speed, 78 m.p.h.; hovering ceiling, 2,200ft; service ceiling, 9,800ft.

Ka-18 This is a development of the Ka-15 having a lengthened and redesigned forward fuselage, with a cabin accommodating four persons instead of two. The structure is a welded steel-tube truss with a monocoque tail boom, and the fuselage is dural-skinned.

● Rotor diam, 32ft 8in; empty weight, 2,270lb; gross weight, 3,300lb; cruising speed, 80 m.p.h. approx.

Mikhail Mil

Mi-1 The latest development of this very extensively used helicopter is a refined version named the Moskvich. It is illustrated in an accompanying photograph. Day and night all-weather capabilities are reported, and the cabin, seating the pilot and three passengers, is soundproofed. Hydraulically controlled all-metal rotor blades are fitted. The common passenger version of the Mi-1 has three to four seats and the agricultural version carries about 880lb of chemicals in tanks one on each side of the fuselage. For ambulance duties panniers for stretcher cases can be similarly disposed. In the mail-carrying role also auxiliary panniers are used. The engine is an AI-26V giving 575 h.p. for take-off.

Mi-3 A development of the Mi-1, having four-blade rotor and modified fuselage.

Mi-4 This very successful medium-sized helicopter is now meeting with success in the export market. The normal military model can accommodate the Soviet equivalent of the jeep, a small car, a 75mm anti-tank gun, or two motor-cycle sidecar combinations. Fourteen armed soldiers are another possible load and a passenger version supplied to Austria can seat up to 16. The variant used by Aeroflot is known as the Mi-4P and seats ten passengers while providing ample space for luggage. This version is characterized by square—instead of round—windows, and there is no underslung gondola for the navigator, as on the military machine. In one agricultural version the gondola is used as a distributing point for chemicals.

Ka-18

The standard powerplant of the Mi-4 series is the ASh-82V developing 1,700 h.p. Provision is made for blind- and night-flying, and there is an anti-icing system, as on the smaller Mi types. The four-bladed main rotor has hydraulic servo control. A notable feature of the metal fuselage, especially from the military aspect, is the clamshell doors at the rear.

● Rotor diam, 68ft 11in; gross weight, 15,873lb; disposable load, 2,645-3,527lb; max speed, 116 m.p.h.; ceiling, 19,750ft.

Mi-6 The world's largest helicopter, the Mi-6 is powered by two Soloviev TB-2BM shaft turbines each of 4,635 h.p. These were specially designed for this application and are mounted atop the forward fuselage. Wings are fitted to unload the five-blade rotor, which is said to measure well over 100ft in diameter. Gross weight is believed to be at least 70,000lb. The most recently publicized version is fitted, as shown in the accompanying picture, with wings which unload the main rotor. Several records stand to the credit of this huge helicopter, including a speed of about 167 m.p.h. over 100km. closed circuit. A 10,000kg load has been lifted to over 16,000ft.

Yakovlev

Yak-24 Little new information concerning this tandem-rotor helicopter has been received since our previous review. The latest known version is the Yak-24K, apparently developed for Aeroflot and having luxury accommodation for nine passengers. Very large windows are fitted and auto-stabilization is reported to be a feature. The standard powerplant of the Yak-24 is two ASh-82V 14-cylinder radial engines each of 1,700 h.p. In military models at least there is a loading ramp for wheeled or track vehicles and heavy military equipment. The cabin measures some 33ft in length and will accommodate two lorries or jeeps, a twin 14.5mm anti-aircraft gun, with its crew, or as many as 40 troops.

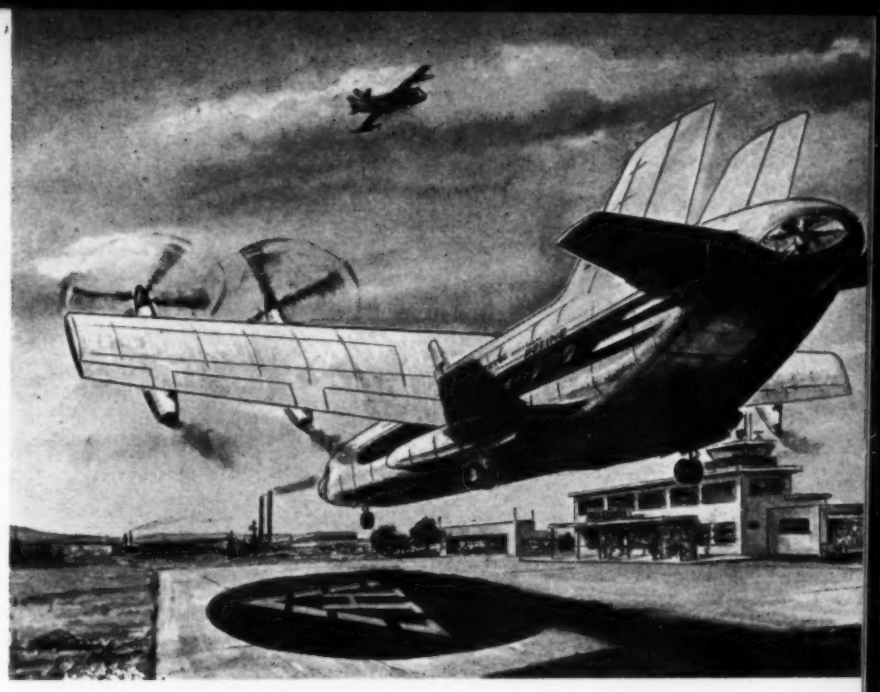
● Gross weight, 32,000-36,000lb; cruising speed, over 120 m.p.h.

(*continued on page 635*)

Mi-6

Yak-24K

VTOL — now or never



BY JOHN W. R. TAYLOR

THE whole future of VTOL flight may depend on what happens in the next twelve months. After years of patient, costly development and experiment, we have in the Vertol 107 and Sikorsky S-61 a pair of big commercial helicopters with operating economics that no longer look like something out of *Alice in Wonderland*. A few years later is the Westland Rotodyne, which should be better still.

It is not enough for the handful of established helicopter airlines like New York Airways, Los Angeles Airways and Chicago Helicopter Airways to order a total of fewer than 20 S-61s and 107s. If we are ever to have a network of short-haul helicopter services on a worldwide basis, some bold and expensive decisions must be taken now; and this concerns Britain most of all, for no city on earth is better placed than London as the centre for such a network.

The faint-hearted will protest that there is no proof that these new helicopters can be operated efficiently and without vast subsidies. They point to other forms of VTOL aircraft such as tilt-wing and fan-lift aeroplanes, or even the Griffith proposal for a supersonic jet-lift airliner, and ask whether it might not be wiser to pour all available funds into the development of these potentially better projects.

Such people would never have dreamed of opening the pioneer cross-Channel air services with D.H.9s and H.P.0/400s in August 1919. They would have wanted proof that the operations were feasible, and Britain would have been left behind. Nor would they have contemplated ordering the incomparably successful H.P.42s in 1929, in case somebody produced a better aeroplane—perhaps one of the new-fangled monoplanes—within ten years.

In those days, of course, operators did not have to think in terms of ten years. The revolutionary Short Empire flying-boats were ordered in 1935. The prototype flew on July 4, 1936, and entered regular passenger service less than four months later, on October 31—a total development period of under two years.

If this pace of development could be matched by modern helicopters and VTOL aircraft, a wait-and-see attitude might be justified. But a glance at the record reveals a very different picture.

It is nearly ten years since Fairey Aviation began design work on the Rotodyne. The prototype flew three-and-a-half years ago, on November 6, 1957. If, as should have happened long ago, sufficient money is put into the development programme by the Government, the Rotodyne may be ready for service by the mid-sixties—a total development period of some 15 years.

It can be claimed that the Rotodyne is revolutionary; but so are all the alternative types of VTOL aircraft. Its design has been improved tremendously since the early fifties; yet what worthwhile modern transport aircraft does not show improvement between the project stage and operational use? Its development *could* have been speeded by Government subsidy; but how many modern British aircraft, civil or military, have been able to progress from design to production without perpetual policy changes, specification changes and threats of imminent cancellation? So there is no reason to feel that 15 years is an unduly long period in which to expect a VTOL aircraft to reach maturity.

This time-scale must be borne in mind whenever VTOL operations are contemplated. It is quite wrong to imply, as many people do, that the Rotodyne is so close behind the Vertol 107 or Sikorsky S-61 as to be considered contemporary; or that the other forms of VTOL aeroplane are within such easy reach that the stage of development represented by the Rotodyne could be omitted. Even less realistic is the familiar suggestion that Britain should take another mighty leap forward, by-passing the "conventional" supersonic airliner and producing a VTOL supersonic airliner of the Griffith jet-lift type by the end of the 1960s.

Let us not say that this would be impossible, for our aircraft industry is second to none when given its head; but post-war history proves that such speedy development is extremely improbable, and that it is potentially disastrous to stake everything on a mighty technological leap in the dark.

Already the prediction that all major airlines will be flying supersonic airliners by the late 1960s is beginning to appear hasty. Delegates to IATA's 14th Technical Conference at Montreal a couple of weeks ago were inclined to think in terms of the 1970s. Several of the more hard-headed favour the late 1970s now that work on the North American B-70 Mach 3 bomber has been slowed down.

It would hardly be reasonable to expect a VTOL supersonic airliner to be ready for service before a "conventional" type. So, while doing everything possible to maintain the leadership given us by the Short SC.1 and, in a different field, the Hawker P.1127, it is time for this country to work out—and stick to—a realistic policy on VTOL flight for the next ten years.

A Policy for BEA British European Airways were among the pioneers of helicopter operation, their early achievements including the world's first helicopter night-mail service (on February 21, 1949) and the first regular passenger services, in June 1950. There are plenty of indications that they would like to get on with the job of building up a network of helicopter passenger services in and from the UK, but that they are being hampered by lack of imagination and courage in those who hold the purse-strings.

A Penzance-Scilly service operated with a commercial development of the Belvedere, as has been suggested, would be a step in the right direction, but a hardly adequate one. Even if the aircraft equalled the Vertol 107 and Sikorsky S-61 in efficiency, it would not be available as quickly and would hardly attract sufficient overseas interest to justify the cost of its development. Nor is the Penzance-Scilly route, by itself, worthy of one of Britain's national airlines, which had the courage in the 1950s to set the pace in turbine transport operation.

We should admit we have nothing to compare with the Vertol and Sikorsky designs at the present time, and order a large enough quantity of one of them for BEA to open a worthwhile network of passenger services based on London.

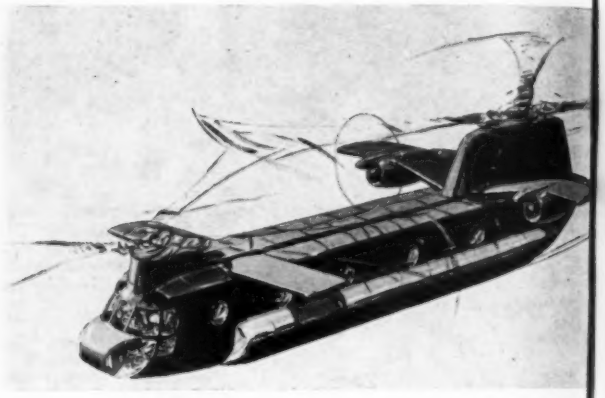
Not having seen the S-61, it would be invidious to state a preference for either of these US helicopters. Both are basically 25-seaters and both are powered by General Electric CT58 shaft-turbines.

In the heading picture: Vertol take a look ahead towards tilt-wing commercial transports powered by four 2,650 h.p. T64 engines

Wind-tunnel model of a projected assault transport built round two Chance Vought ADAM (Air Deflection And Modulation) propulsion/control packages. Four J60 turbojets above the wing drive ducted fans with air-deflection nozzles

Sikorsky S-58s. If they bought S-61s or Vertol 107s, a pooling arrangement with BEA would offer passengers a closely knit network of city-centre services linking London with Paris, Brussels, Antwerp, Lille, Rotterdam, Liège, Maastricht, Cologne, Bonn, Eindhoven, Duisburg and Dortmund. BEA would stand to benefit from the unrivalled operating experience acquired by Sabena since they opened the world's first international helicopter passenger services in September 1953.

There is little doubt that a scheme of this kind is practicable today, and something must be done soon if BEA are to maintain their reputation as a helicopter-minded airline. The problem of providing a heliport in London remains, and it is one we should be foolish to dismiss lightly. The Westland Heliport at Battersea, while deserving all praise for the initiative that brought it into being, is not in the right place for regular international passenger services.

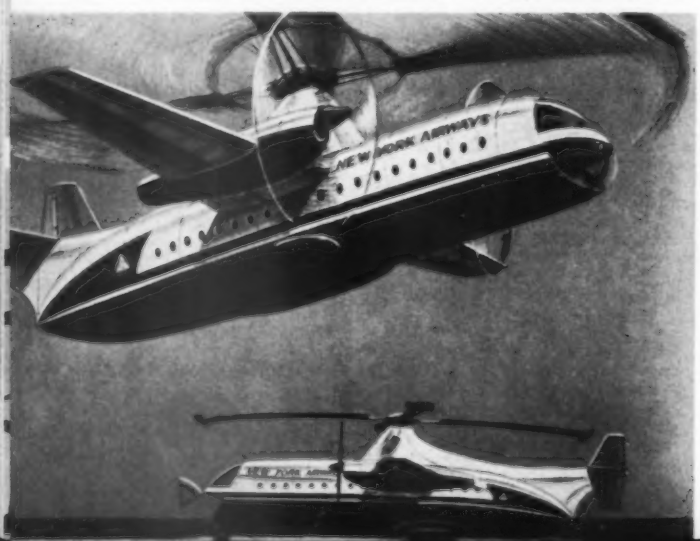


Left, a model of Sikorsky's S-57 tactical fighter design-study, with retractable rotor. Right, the 227kt Compound Chinook proposed by Boeing-Vertol

VTOL—now or never...

This means that dollars could be saved by installing DH Gnomes, which are the same engines built under licence in the UK. The Vertol 107 should offer the advantage of greater c.g. travel, because of its tandem-rotor layout. The absence of a high-speed tail rotor might also make it less noisy—and this could well be a critical factor in considering city-centre operations in London. On the other hand, the close links between Sikorsky and Westland might add to the attractions of the S-61.

Both types would make possible non-stop services from London to Paris, Brussels, Rotterdam and the Channel Islands, and to Manchester and numerous other cities in Britain. Prestige-wise, and because heavy traffic already exists on the routes, it would appear preferable to start with the London - Paris - Brussels - Rotterdam network. Duplication with Sabena's well-established helicopter services could be avoided by pooling arrangements of the kind that are now normal on fixed-wing services. Furthermore, Sabena themselves must be in the market for a replacement for their



An interim answer would be to follow the example of the Port of New York Authority in providing city-centre heliports on piers over the river. One alternative would be a semi-mobile base of the barge type, which could be moved experimentally from point to point until a site was found that offered a good operating environment for both the aircraft and, in terms of noise, for those living and working in the vicinity.

What would be the prospects for a cross-Channel helicopter network of this type, operating from a heliport near the City of London? The big attraction, of course, would be the elimination of city-centre-to-airport journeys at each end, leading to a reduction of some 50 per cent in overall travelling time even in comparison with the latest jet airliner schedules. Fares would, inevitably, be higher: but the increase would be offset by the saving in airport coach or taxi fares and in time. Businessmen could quite easily fly from London to Paris in the morning, spend several hours in conference and return in the late afternoon—which may seem an awful waste of a trip to the Gay City, but does demonstrate the possibilities of such a service.

Lessons from New York For the businessman in a hurry, fares are often a secondary consideration. This point was made by Sir Ralph Cochrane in February during his Brancker Memorial Lecture, when he remarked that:—

"As an example of costs, Mr Robert L. Cummings, President of New York Airways, spoke in a recent paper of a fare of 48 cents (3s 5d) a seat-mile, but indicated that nevertheless they expected to be carrying a million passengers by 1963, with a rapid increase thereafter. That is an example of the amount which passengers are prepared to pay if they can be saved the time necessary to force their way into the city from an aerodrome outside."

The very short stages over which New Yorks Airways fly most of their services are in contrast to the 200-mile cross-Channel routes considered above for BEA; but much can be learned from the New York operations, particularly in respect of aircraft reliability.

Figures just issued show that the company's present fleet of five Vertol 44s, in service less than three years, have each logged more

US manufacturers regard the compound helicopter, with off-loaded rotor, as an essential step between the pure helicopter and future VTOL transports for passenger and freight work

than 4,000 flying hours, with a total flight time of more than 22,000hr. During 1960 these aircraft made over 40,000 scheduled flights, of an average duration of 12min. Excluding delays and cancellations caused by weather, the single-engined Model 44s departed within five minutes of the scheduled time on 98.8 per cent of the flights.

Soon the 15-passenger Model 44s will be replaced by a new fleet of 25-passenger Vertol 107 Model IIs, with all-weather capability and all the advantages of a twin-turbine installation over the single piston-engine of the earlier type. It is this initial re-equipment that enables Mr Cummings to look forward to one million passengers annually by 1963, compared with a *total* of something over half-a-million in the past nine years.

Furthermore, the 107 Model II represents only the start of the development of this aircraft. In the design stages is a cleaned-up version, the Model VI, with retractable landing gear, extended and pointed rear fuselage, rotor hub fairings and wider-chord blades, which will offer a cruising speed of 175kt compared with the 135kt of the Model II.

Already, a larger and more advanced version of the 107 is in production for the US Army as the Chinook. A commercial counterpart has been projected, with 48 seats and a cruising speed of 160kt. Even more attractive is a proposed "compound" version, with stub wings fore and aft and a twin-turboprop powerplant. By converting to autogyro configuration in cruising flight, with the rotors autorotating, it would be able to fly at approximately 230kt.

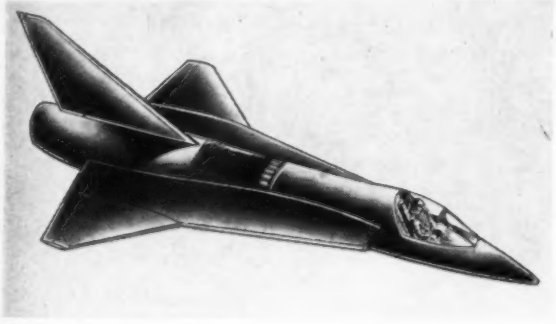
This Ryan project for a Vertifan-equipped jet airliner would offer VTOL, high cruising speed, and hovering ability. Air deflection vanes above and below the tip-driven fans close to seal the wing in forward flight

Comparative Performance and d.o.c. per Available Seat-n.m. at 100 n.m. Stage-length (Figures by Vertol)

Aircraft	107 Model II	107 Model VI	Chinook	Compound Helicopter	Tilt wing	F-27
Engines and h.p.	(2) T58/1,250	(2) T58/1,400	(2) T64/2,650	(2) T64/2,650	(4) T64/2,650	(2) RDa.6/1,720
Gross Weight* (lb)	18,450	19,130	32,000	33,800	45,000	35,700
Weight empty (E) (lb)	11,210	11,925	19,392	22,450	27,400	22,237
Fixed useful load (lb)	634	634	646	646	706	917
Fuel (100 n.m. + 30min cruise) (lb) ...	1,606	1,550	2,525	2,105	3,620	1,900
Payload/Passengers (P) (lb/no)	5,000/25	5,025/25	9,437/47	8,599/43	13,274/66	10,646/40†
Cruising speed (kt)	138	176	160	227	327	220
Blockspeed (with 10kt headwind) (Vb) (kt)	123	157	143	202	287	138
PVb/E (kt)	55	66	70	77	140	86
Direct operating cost per seat-mile (c) ...	7.33	6.53	5.49	4.86	3.50	3.33

* Based on one engine out, 70°F at sea level. † Space limited.

For over six years Short Bros & Harland Ltd have been investigating VTOL possibilities. As a background to the SC.1 are numerous studies ranging from light fighters to big supersonic aircraft. Below is a strike fighter design directly derived from the SC.1



This drawing by a Sikorsky artist envisages crane helicopters picking up passenger-pods from a city-centre heliport for delivery to an airport, where they would be set down at the end of the runway and the passengers transferred without delay to waiting airliners

Statistics of this kind emphasize the potential importance of the compound helicopter, so it is not altogether surprising that Sikorsky have come to much the same conclusions as Vertol. In a study entitled *The Helicopter as a Competitive Transport Vehicle*, published in the July 1960 issue of the *Journal of the American Helicopter Society*, Ralph B. Lightfoot, Sikorsky's chief engineer, compared the flight characteristics of a modern turbine-powered helicopter and its derivatives with other forms of VTOL aircraft. Using as a basis the requirement to carry 40 passengers for 260 n.m. Mr Lightfoot reached these conclusions:—

"It is found that the downwash characteristics of high disc-loading aircraft such as the lift-fan and (commercial) tilt-wing are prohibitive,

Cruising speed tells only part of the story. More important in many respects are operating costs. Figures issued by Vertol (see table) show that the 107 Model II has an estimated direct operating cost of 7.33 cents per available seat-nautical-mile over the optimum range of 100 n.m., compared with 6.53 cents for the 107 Model VI, 5.49 cents for the commercial Chinook and 4.86 cents for the Compound Chinook. These costs are put into perspective by a figure of 3.33 cents for the Fairchild F-27 at the same range, which is by no means the optimum for this fixed-wing transport.

VTOL—now or never . . .

due to high fuel consumption, short hover-time and super-hurricane wind effects. The operating costs of the helicopter-type vehicles are lower than the other proposed VTOL aircraft. The hovering endurance of the helicopter is superior . . . a compound version of the helicopter offers the most satisfactory solution to date."

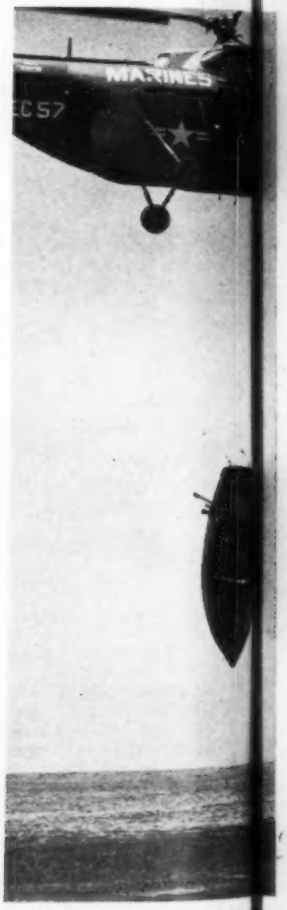
Only on the tilt-wing configuration do Vertol and Sikorsky differ, for Vertol's study of a 45,000lb tilt-wing transport, powered by four 2,650 h.p. T64 engines, indicated a direct operating cost of only 3.5 cents per available seat-nautical-mile over a range of 100 n.m., which compares very favourably with fixed-wing aircraft.

Even if there is American military finance for the development of a tilt-wing transport, any commercial version must still be many years away. So the helicopter and its derivatives can be expected to dominate the commercial VTOL scene for at least another ten to 15 years.

As the Compound Chinook and its Sikorsky counterpart are still paper aircraft, it becomes clear why Britain should buy either the Vertol 107 or S-61 to meet her present needs and concentrate all possible effort and money on perfecting the Rotodyne. Here we have a compound helicopter in being, with a payload capacity exceeding that of the US projects and a potential performance almost as high. There are problems to overcome, including the noise inherent in the pressure-jet rotor system; but immense problems have already been overcome in getting the Rotodyne to its present stage of development.

Let it never be forgotten that if we don't develop the Rotodyne and sell it on a large scale, Britain may be out of the transport helicopter business for a very long time, with nothing bigger than a Wessex to offer.

Even now, the only major airline which operates helicopters and which is not using or contemplating American equipment is Aeroflot. The Russian operator continues to get by with the workmanlike but small Mi-4 on what is reputed to be the world's most extensive VTOL network. There is little evidence that the tandem-rotor Yak-24 is in commercial service as anything but a fabulously uneconomical nine-passenger VIP transport. Nor has there been any recent news of the Mi-6 or more advanced projects. However, Russia has a habit of occasionally pulling thoroughly practical and eye-opening aircraft out of the bag, and it would be unwise to imagine that the men of the Mil, Kamov and Yakovlev design bureaux have run out of ideas.



A 14ft inflated rubber boat is dro during a demonstration of a new nique for putting reconnaissance enemy territory

Having spotted a forest fire, the 12E will be able to douse it wit water, carry in fire-fighters and hose on the ground. According t Service, an uncontrolled fire can energy in seven minutes as on

Flying cranes in action. The Sikorsky S-60 (left) is unloading standard Army cargo containers from a ship. The Belvedere airlifts a Land-Rover

Flying Cranes The Mi-6, which lifted a payload of 26,464lb to a height of 2,000m in 1957, still holds world records for speed (167.2 m.p.h. over a 100km closed circuit) and sheer size (its loaded weight is around 70,000lb); but Sikorsky also are thinking big.

Years before most other people, Igor Sikorsky foresaw the possibilities opened up by the flying crane. He had an opportunity to demonstrate his ideas on a small scale in Korea, where S-55s were used to haul net-loads of supplies and equipment to troops in front-line positions. Since then the technique has become routine for helicopter operators, but Sikorsky continues to set the pace.

No operation proved this more clearly than when engineers of the Puerto Rico Water Resources Authority based an entire power-line construction project around the use of an S-58, from the initial survey work to completion of the lines. The task included planting the 65ft, 3,750lb transmission-line poles, setting twin cross-arms atop the H-frames formed by the poles, stringing the cables across miles of hills and valleys, planting the smaller rural electrification poles and removing old poles, which the S-58 yanked out like pulling teeth.

In one mountainous area, the helicopter planted 100 rural electrification poles in a day, a job that would have taken three or four months by manpower. After ten months of operation, the Puerto Rican engineers estimated that the savings in time and manpower had already written off the purchase price of the S-58.

Inspired by such exploits, Sikorsky have been planning bigger and better flying cranes, designed specifically for the job. The first was the S-60, with the simplest possible airframe that could be built around the well-proven S-56 rotor/engine system. Late this year they will fly the prototype of the much-improved S-64 Skycrane. Powered by two 4,050 s.h.p. Pratt & Whitney JFTD-12 shaft-turbines, it will have a payload capacity of eight metric tons—over 50 per cent of its take-off weight. And this is only the start, for later Skycranes will increase steadily in size and payload, the present "ultimate" being a four-turbine model with a ten-blade rotor, take-off weight of 230,000lb and payload of 80,000lb.

But the future in commercial helicopter operation does not lie entirely with large passenger and freight transports, for there will always be plenty of work for the smaller general-purpose rotating-wing aircraft.

At the beginning of this year, there were in the United States and Canada about 200 commercial operators, 100 executives and companies, and some 30 government agencies flying a total of nearly 1,000 helicopters. In size, the organizations ranged from those flying a single three- or four-seat Bell or Hiller to big fleet-owners like Petroleum Helicopters and Okanagan. The comparable figure for helicopters on the British Civil Register was 42, the majority of which belong to British United Airways companies.

The types of work done by these small "choppers" have been described in previous helicopter special issues of *Flight*. It is doubtful if any other type of VTOL aircraft will ever out-perform the light helicopter in this sphere, but that does not mean there will be no progress. For example, the maximum hovering ceiling for a type like the Hiller UH-12 was about 3,000ft in 1957. By last year, with the use of a turbo-supercharger, it had gone up to 17,000ft. Now, with the introduction of turbine power, it will soon be 25,000ft. Simultaneously, the payload of the UH-12 has increased by nearly 70 per cent.

Of particular importance is that the basic design of the UH-12 has remained unchanged, so that owners of early models have been able to up-date their equipment to take advantage of each gain in performance.

An idea of the hold which America has on this market also is given by the fact that 73 per cent of the commercial and civil government-operated helicopters of the non-Communist world are of Bell manufacture. But competition is growing. Sud-Aviation have sold more than 740 of their fine turbine-powered Alouette IIs—quite a number of them to commercial operators—with the improved Alouette III already following in production; while Westland have high hopes for a commercial version of the Wasp.

What of the personal helicopter, the one-time dream of a "flying motor car" in every garage? Stanley Hiller is quite clear on the subject. In an article for the November 1960 issue of *The Financial Analysts Journal*, he commented:—

"The industry has come to realize—after too many years of misdirected energies and frustrated hopes—that a mass market for a vertical flying flivver just isn't there. Not now at least; nor will it be for years, if ever. For one thing, it's doubtful if the price of a helicopter can ever be brought down to the level of the ordinary wage-earner. And if it ever reaches such a quantity market, the traffic control problems will be staggering."

One company that feels differently is Umbaugh Aircraft Corporation, which has a sub-contract with Fairchild for the manufacture of up to 10,000 of its little two-seat Model 18 autogyros—admittedly not helicopters—per year. It claims that it has cash deposits for 6,000 aircraft, so we must wait and see.

Several other US companies have been formed to market small autogyros; but the only personal rotorcraft that are yet appearing in impressive numbers are the tiny "home-builts" of Igor Bensen,

"The only major airline which operates helicopters and which is not contemplating or using American equipment is Aeroflot." In this picture an Mi-4P is seen over Sheremetievo Airport, Moscow

This Westland Wessex has been fitted with experimental flotation bags under a Ministry of Aviation contract

VTOL—now or never . . .

whose opinions are therefore worth quoting. In a recent letter to the writer, Mr Bensen said:—

"Our views on VTOL are quite different from those prevailing in the industry and military services. We are dedicated to the development of commercial, privately-owned VTOL aircraft in the price range suitable for middle-class citizens. That this can be accomplished is evidenced by the existence of Bensen Gyro-Gliders and Gyro-Copters, which are quantity produced and sold at the price level of automobiles. To be sure, Bensen Gyros are not yet fully-fledged VTOLs, but they are stepping stones to the development of the B-9, B-10 and B-12 [not yet announced], which *are* VTOLs."

Military Development and the Future Whoever is right—Mr Hiller or Mr Bensen—commercial helicopters will become an increasingly familiar sight in the skies all over the world in the next decade. The same is true of military helicopters; but there is a growing tendency to restrict the number of different types ordered for service, and this is going to make life hard for the smaller manufacturers.

For example, the US Army's Chinook is intended to replace not only a variety of different helicopters but several fixed-wing types as well. Similarly, the light observation helicopter (LOH) being sought in quantities of up to 5,000 will replace current light helicopters, plus two types of fixed-wing aircraft. Whoever wins this particular contract will be in a very happy position, for it will make possible the parallel production of small commercial helicopters of high performance and low price.

However, the most important of all the new US military programmes in the VTOL field is probably the recently announced co-operative scheme of the Army, Air Force and Navy to provide heavy funding for transport-size VTOL prototypes. It is felt that much of the $100m spent on 20 different types of VTOL aircraft over the past ten years has been wasted on vehicles with no real military potential. In contrast, the new "Tri-Service VTOL" is regarded as the first major step towards operational military (and, later, commercial) VTOL transports.

Needless to say, the new requirement is causing intense competition. It is also leading to voluntary groupings of companies—groupings which could have far-reaching effects on the structure of the US industry. For example, Chance Vought, Hiller and Ryan are competing as a team, despite the fact that Chance Vought have been working on the ADAM ducted-fan jet-deflection configuration, Hiller are tilt-wing enthusiasts and Ryan have concentrated lately on aircraft built around the horizontal tip-driven lift-fan units under development by General Electric.

The general opinion in America is that the competition will be won with a turboprop-powered tilt-wing configuration. This puts Hiller nicely in the running in view of their experience with the X-18; though it should not be forgotten that Vertol have had considerable success with their smaller tilt-wing Model 76.

The latest news of the X-18 is that it has completed over 100 hours of ground and flight tests and 20 successful flights, during which the wing angle-of-attack has been increased to a maximum of 50°. It will soon enter a special ground test rig to evaluate the effect of downwash on the machine's environment during hovering. After that, it is planned to resume flight tests and to attempt free-flight hovering.

During Army exercise White Swan, the Rotodyne (below) displayed its possibilities as a casualty-evacuation aircraft. The Bell 47G-2A above is one of the fleet of helicopters used to ferry men and equipment to and from offshore oil drilling rigs in the Gulf of Mexico

Main competition for the tilt-wing may come from the lift-fan, but this device has yet to leave the ground. The only certainty is that, whatever configuration is chosen for the "Tri-Service VTOL," it is many years away as a practical production aircraft. Meanwhile, apart from research aircraft, the term VTOL is still synonymous with "helicopter," with one exception—the Hawker P.1127. This aircraft, or a supersonic development, could provide a superb replacement for the present generation of tactical fighter-bombers and reconnaissance aircraft in the mid-sixties, and no effort should be spared to bring this to pass. The name of its designer, Sir Sydney Camm, is sufficient guarantee that, unlike many other VTOL projects, it will work.

We in Britain should never worry if other nations sometimes appear more venturesome, with ADAMs, tail-sitters, lift-fans, tilt-wings, coleopters, tilting ducts, tilting rotors and ring-wings—for experience has shown that not one in ten of the departures from the conventional in aviation ever succeeds. The art is in choosing the exceptions, and Britain might well have three of them in the Rotodyne, P.1127 and the Short/Griffith type of jet-lift aircraft.

BS
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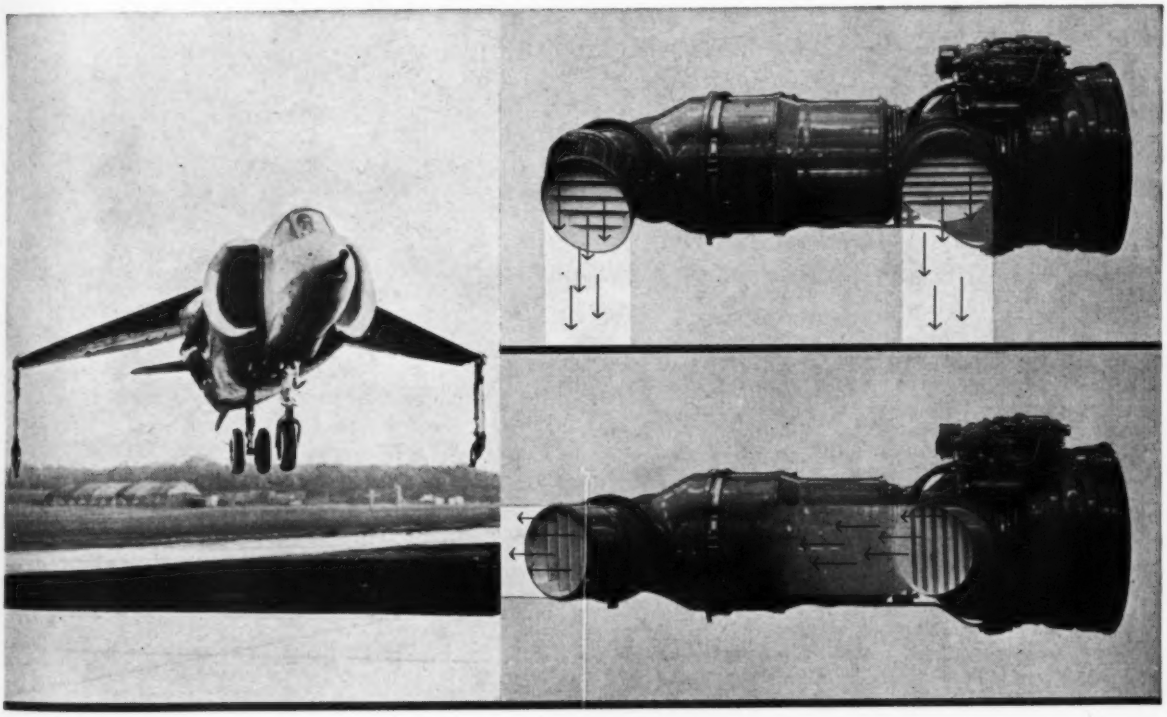
LIFT and THRUST from ONE ENGINE– the revolutionary BS 53 Pegasus turbofan



The new Bristol Siddeley BS 53 Pegasus high-ratio turbofan represents a major engineering breakthrough in the field of aircraft propulsion.

Because the Pegasus can be fitted with movable nozzles evenly disposed around the centre of gravity which give directional control to its total thrust, this remarkably versatile engine provides the airframe designer with *a single power source for all conditions of flight.*

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The Bristol Siddeley Pegasus has already been selected for, and is now undergoing trials in the Hawker P 1127 VTOL light strike fighter and is supported by the Mutual Weapons Development Programme for NATO.

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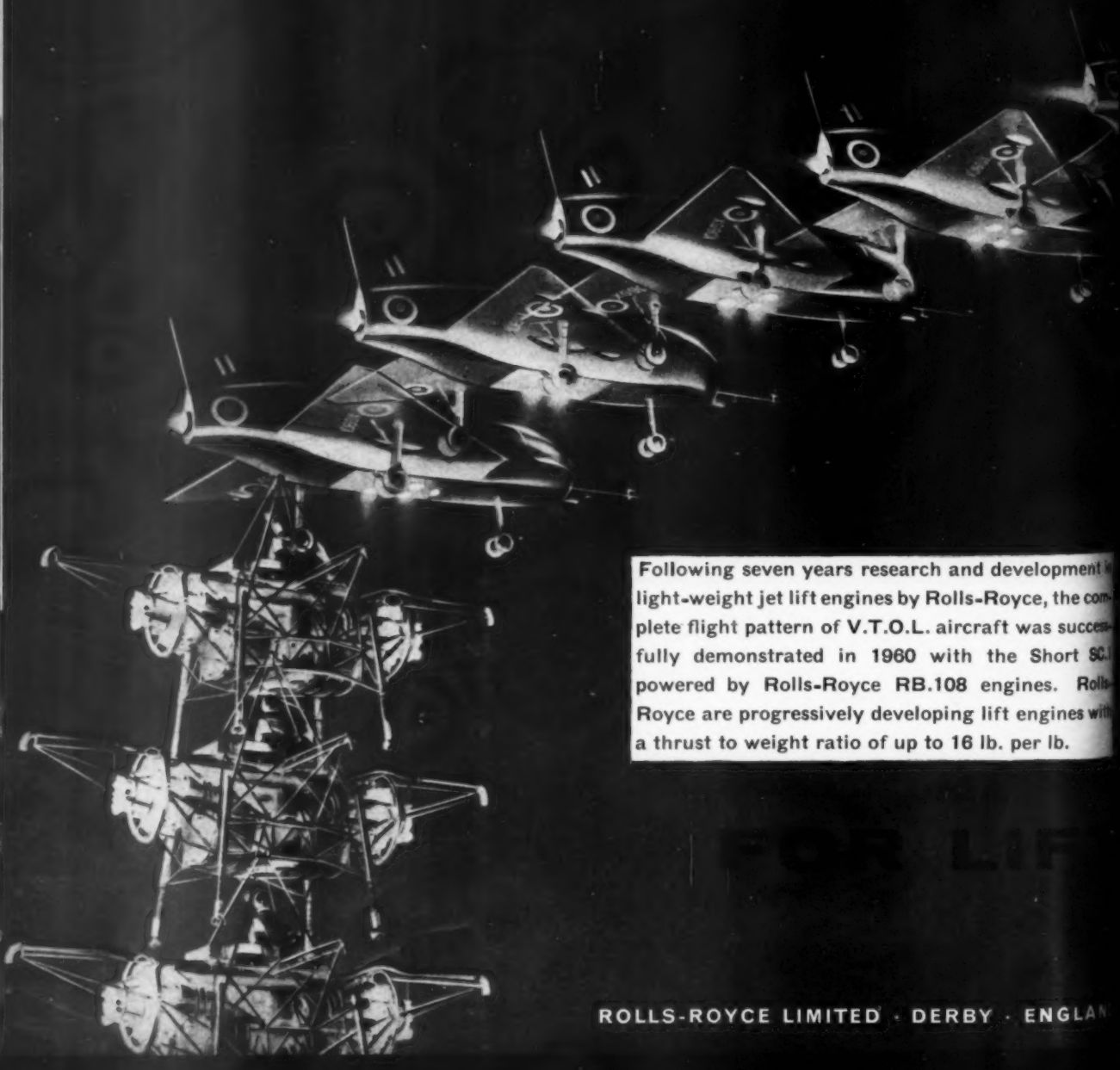

Following seven years research and development in light-weight jet lift engines by Rolls-Royce, the complete flight pattern of V.T.O.L. aircraft was successfully demonstrated in 1960 with the Short SC.1 powered by Rolls-Royce RB.108 engines. Rolls-Royce are progressively developing lift engines with a thrust to weight ratio of up to 16 lb. per lb.

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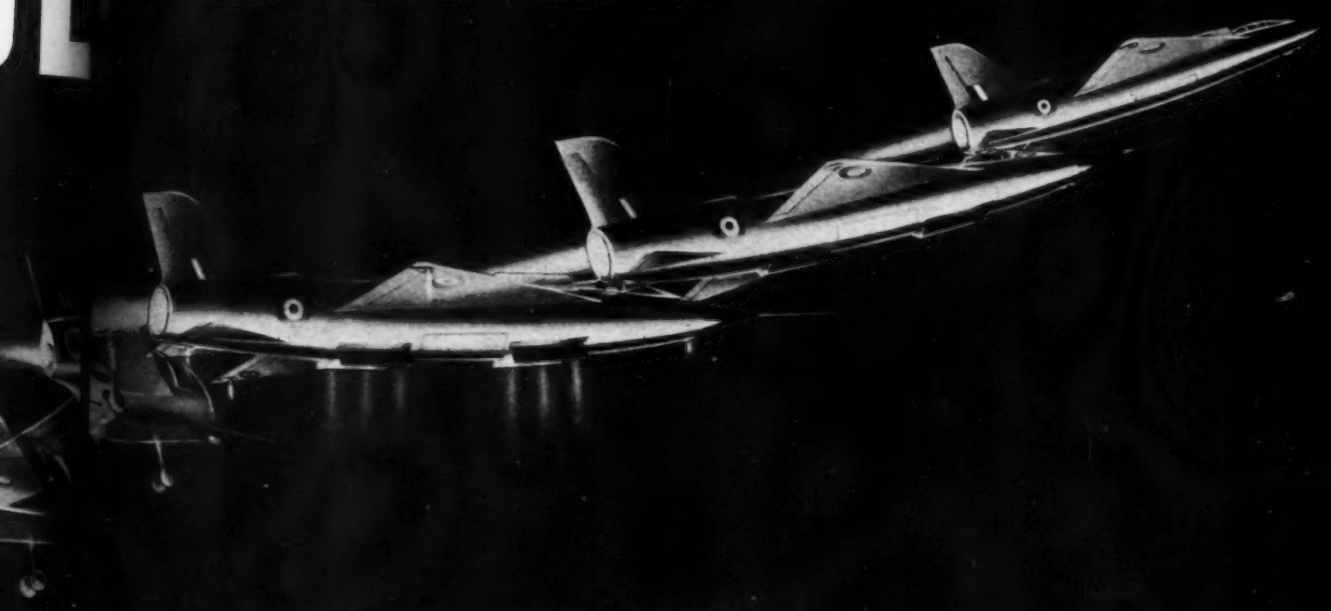

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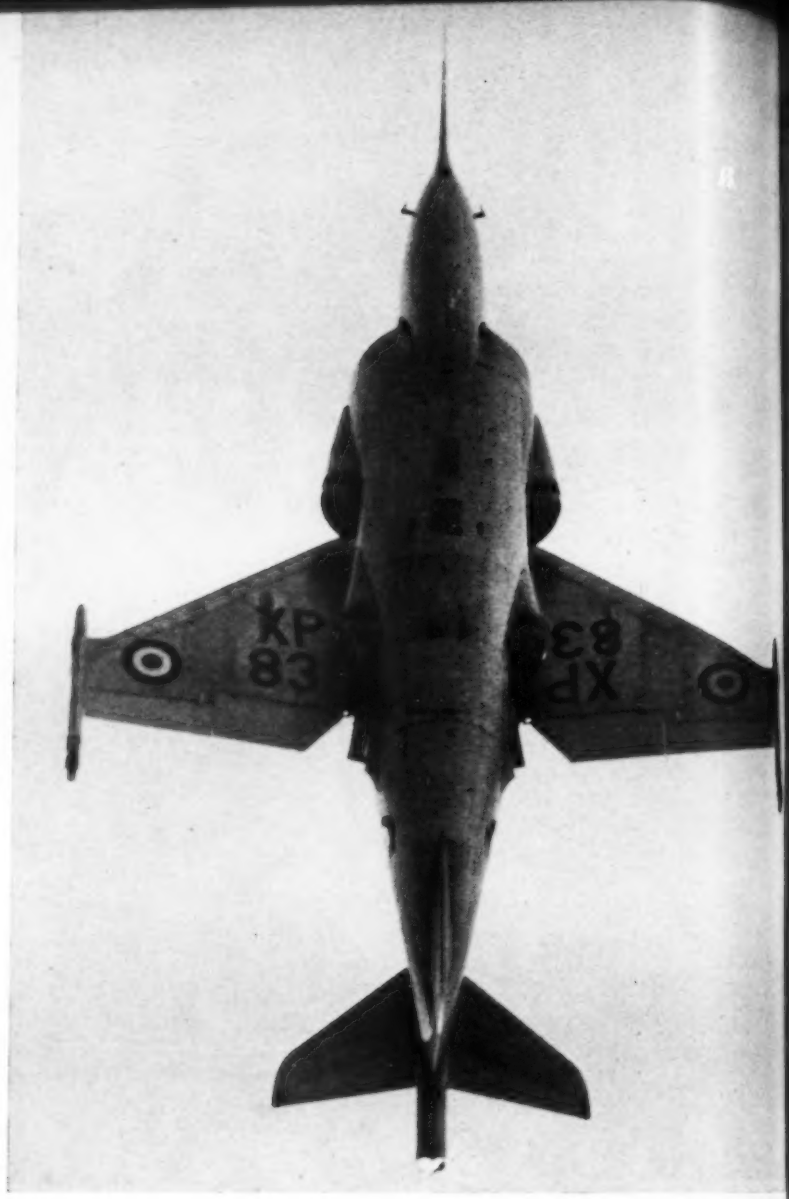

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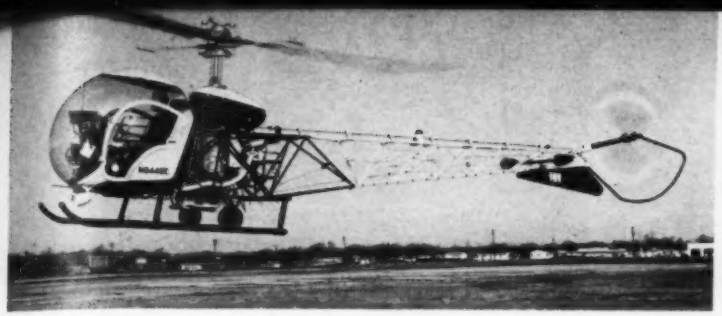


Bell 47G-2A

Aerotecnica AC-14

VTOL INTERNATIONAL SURVEY (from page 628) . . .

SPAIN

Aerotecnica S.A.

Velazquez 38, Madrid

AC-12 In this helicopter high concentration of mass is achieved by mounting the Lycoming O-320 168 h.p. engine above the cabin, close to the rotor head. Two fans draw cooling air down through oil coolers past the two pairs of cylinders. The rotor-head controls are of ingenious layout and are claimed to provide balanced, light forces without any form of power assistance.

● Rotor diam, 27ft 10in.; length, 22ft 8in; empty weight, 1,280lb; gross weight, 1,800lb; max speed, 87 m.p.h.; cruising speed, 71 m.p.h.

AC-14 A five-seater, this is powered by a Turboméca Artouste 2 of 400 h.p. The engine is mounted, like that of the AC-12, above the cabin, and the high-inertia rotor runs at constant speed. Construction of the four main-rotor blades is similar to that used in the AC-12, but the complication and relative unreliability of a tail rotor has, according to the designer, been avoided by using the residual thrust of the engine for anti-torque power. This air is led to the tail and vented into a bifurcated nozzle. The end of the tail-pipe can be swivelled from the rudder pedals to alter the proportion of air deflected in each direction and achieve directional control. At the same time the rudder linkage moves twin fins, which assist in providing directional control after engine failure.

● Rotor diam, 31ft 6in; length, 26ft 6in; empty weight, 1,378lb; gross weight, 2,646lb; max speed, 118 m.p.h.; cruising speed, 103 m.p.h.; hovering ceiling in ground effect, 16,075ft; range, 280 miles.

U S A

Bell Aircraft Corporation

Fort Worth, Texas

Model 47G-2A Trooper This is an improved three-seater using a new rotor system which enables it to carry 30 per cent more payload. The tail boom has been lengthened and the engine is a Lycoming VO-435 with a take-off rating of 240 h.p.

● Rotor diam, 35ft 1½in; empty weight, 1,638lb; gross weight, 2,850lb; max speed, 105 m.p.h.; hovering ceiling in ground effect, 4,500ft; max rate of climb at s.l., 630ft/min; service ceiling, 8,900ft; max range 202 miles.

Model 47G-3B Trooper Expected to have a higher performance than any earlier models of the 47 series, this new model is powered with a Lycoming TVO-435 equipped with an AiResearch T-11 exhaust-driven supercharger and delivering 260 h.p. for take-off. The transmission system and all main rotor components are interchangeable with those of the 47G-2A and 47J-2.

● Rotor diam, 35ft 1½in; empty weight, 1,713lb; gross weight, 2,850lb; service ceiling, 20,400ft; hovering ceiling in ground effect, 18,000ft; max speed, 105 m.p.h.; rate of climb (s.l. to 15,000ft), 980ft/min; max range, 202 miles; max endurance, 3hr.

Model 47J-2 Ranger Latest development in the Ranger series, the J-2, is intended for business and general industrial use. It is being certificated this year for increased power, improved performance and higher gross weight. Take-off horsepower of the Lycoming VO-540 engine is being raised to 260. Standard interiors are offered with a selection of three colours and the Ranger is also available with Horton-Horton custom interiors at additional cost.

● Rotor diam, 37ft 2in; useful load, 1,120lb.

HUL-1M This is basically the US Navy's HUL-1 (47J Ranger) modified to take an Allison T63 gas turbine rated at 250 s.h.p.

● Empty weight, 1,350lb; gross weight, 2,850lb; service ceiling, 18,000ft; hovering ceiling in ground effect, 13,900ft; max speed, 105 m.p.h.

HU-1B Iroquois The HU-1B succeeds the HU-1A on Bell's production line for the US Army. It is powered with a Lycoming T53-L-5 shaft turbine of 1,000 s.h.p. and the rotor system uses blades of wider chord and of honeycomb construction. Eight passengers can be carried in addition to the crew of two, and provision is made for three stretchers and a medical attendant. Complete particulars of the HU-1B have not been issued, but its principal characteristics and operational roles are similar to those of the HU-1A. Thus, provision is made for more than 2,000lb of armament, including rockets and machine guns. A possible load is six Nord SS.11 air-to-ground missiles carried on lateral booms. The following data relate to the HU-1A.

● Rotor diam, 44ft; fuselage length, 39ft 7in; gross weight, 7,200lb; cruising speed, over 110 m.p.h.; best rate of climb, over 2,000ft/min; hovering ceiling in ground effect, over 14,000ft.

Model 204B Essentially a civil version of the Iroquois, this ten-seater is expected to be available late this year at a price of about $285,000 (£102,000). A Lycoming T53-L-9 turbine is specified. The first executive model displayed has unholstered passenger seats installed in rows of five, three and one, and the makers state, "What little engine noise does generate from the powerful turbine is soundproofed out of the cabin and blue-tinted Plexiglas windows reduce the suns's glare without hindering panoramic visibility." An all-weather instrument flight system is installed.

● Rotor diam, 44ft; empty weight, 4,318lb; gross weight (passenger), 6,500lb; gross weight (cargo), 8,500lb; max speed, 147 m.p.h.; cruising speed (for best range), 126 m.p.h.; max rate of climb, 2,660ft/min; hovering ceiling in ground effect, 17,600ft; range (with 10 per cent reserve), 260 miles.

XV-3 This is a V/STOL convertiplane having a fixed wing and tilting propeller/rotors. In June last year it was reported that the aircraft had accumulated more than 125 flight-test hours, and it was further stated that the test programmes had con-

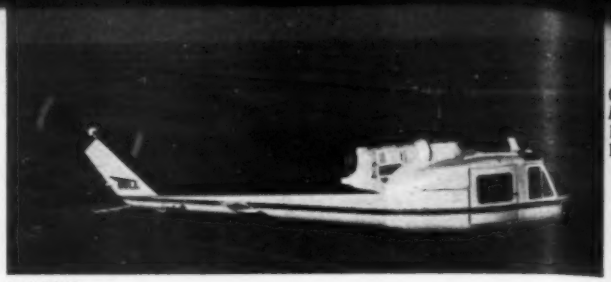
Aerotecnica AC-12

Bell 47G-3B

Bell HUL-1M

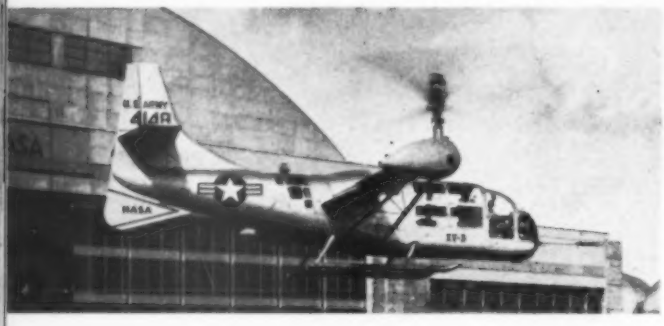
Bell 47J-2

Bell HU-1B Iroquois



Bell 204B

Bell XV-3



Bensen B-8M Gyro-Copter

VTOL INTERNATIONAL SURVEY

firmed the soundness of the basic design concepts, and had demonstrated that the XV-3 represented a practical VTOL type suitable for safe and reliable operation into and out of unprepared confined areas.

Basic concepts which underlay the design philosophy were stated to include low disc-loading for low hovering downwash velocity, moderate powerplant cost and weight and autorotation capability, and a fixed non-tilting wing for the simplest structure control sand engine installation, optimum low-speed aerodynamics and flexible conversion procedure.

The engine is a Pratt & Whitney R-985 of 450 h.p.

● Rotor/propeller diam. 23ft; empty weight, 3,600lb; gross weight, 4,800lb.

Bensen Aircraft Corporation

Raleigh-Durham Airport, Raleigh, N.C.

B-8 Series This series comprises the B-8 Gyro-Glider, an unpowered rotor kite which can be towed behind a car; the B-8W Hydro-Glider, a floatplane version; and the B-8B Gyro-Boat, which incorporates a small dinghy. A powered development, the B-8M Gyro-Copter, is described below.

B-8M Gyro-Copter The Gyro-Copter is offered for amateur construction. The engine is a McCulloch 4318E four-cylinder air-cooled two-stroke giving 72 h.p. driving a pusher propeller. Cyclic pitch is by an overhead azimuth stick or by a floor-type column, and there is no collective pitch control. Yaw control is by rudder and nosewheel steering, and the throttle is a twist-grip on the left handlebar. The two-blade rotor is of laminated plywood construction, with a steel spar. A modified version has been built in Great Britain by Wg Cdr K. H. Wallis.

● Rotor diam, 20ft; fuselage length, 11ft 4in; empty weight, 247lb; normal gross weight, 500lb.

B-9 Little Zipster This is a true helicopter. The engine is a Keikhaefer Mercury Mk 78 and controls are generally the same as those on the Gyro-Copter. It is claimed that an average person who can ride a bicycle can check himself out in the Little Zipster in about 3hr.

● Rotor diam, 22ft; empty weight, 385lb; gross weight, 800lb; max speed, 65 m.p.h.; hovering ceiling in ground effect, 9,000ft; normal range, 100 miles.

Boeing Airplane Company, Vertol Division

Morton, Pennsylvania

YHC-1B Chinook An advanced development in the Vertol Model 107 family of turbine-powered tandem-rotor helicopters, the YHC-1B was the winner of a US Army design competition for a helicopter able to carry up to three tons of payload on 100-mile missions and slightly less than eight tons on alternate missions. Notwithstanding this notable carrying capacity, the fuselage is only 51ft long. The two engines are Lycoming T55s each delivering 2,200 s.h.p. Cargo is loaded through a rear-located ramp which can be left open in flight to permit the carriage of elongated objects. Provision can be made for 33 fully equipped troops or 24 stretcher patients.

● Rotor diam, 57ft; empty weight, 16,318lb; gross weight, 33,000lb; max speed, 174 m.p.h.; cruising speed, 149 m.p.h.; hovering ceiling in ground effect, 4,500ft; service ceiling, 12,300ft; range (with reserves), 220 n.m.

HRB-1 This designation applies to a special version of the Vertol 107 which recently won a competition for a new US Marine Corps assault helicopter. It has a powered blade-folding system which is said to enable the blades to be folded by the pilot in a fraction of the time previously needed by several men to fold the blades manually. The makers report: "For rescue missions the HRB-1 can fly 90 nautical miles, hover, and rescue 20 persons, then return to the point of take-off. Power for the HRB-1 is supplied by two General Electric T58-8 gas turbines. Like other twin-turbine Boeing Vertol helicopters, the special Marine version also includes a dual stability augmentation system developed by Vertol Division engineers. This reliable system gives the helicopter handling characteristics equal to those of fixed-wing aircraft and is the basis for practical instrument flight operations. All-weather capability is provided by engine-inlet and rotor-blade anti-icing, and anti-icing provisions for the pilots' windshield."

Vertol 107 Model 2 The foregoing is the designation of the standard production version of the Vertol 107. It is available either as an airliner or as a utility aircraft, and is claimed to be the first rotary-winged craft able to take off and climb away vertically and approach and land vertically as a routine operation, regardless of wind direction. The first ten Model 2s have been ordered by New York Airways and a mock-up of this company's interior arrangements was recently displayed. We quote a makers' announcement: "With the coming of the Boeing Vertol 107, for the first time, travellers will be able to step from an intercontinental jet airliner into a helicopter fashioned with comparable luxury, convenience and comfort. The mock-up shows the impressive 'picture windows'—17in × 19in—which will allow passengers to take advantage of the unequalled view possible from helicopters. Also featured are theatre-

Bensen Gyro-Boat

Bensen Little Zipster

Scouts by Westland
Skeeters by Saunders-Roe
Whirlwinds by Westland
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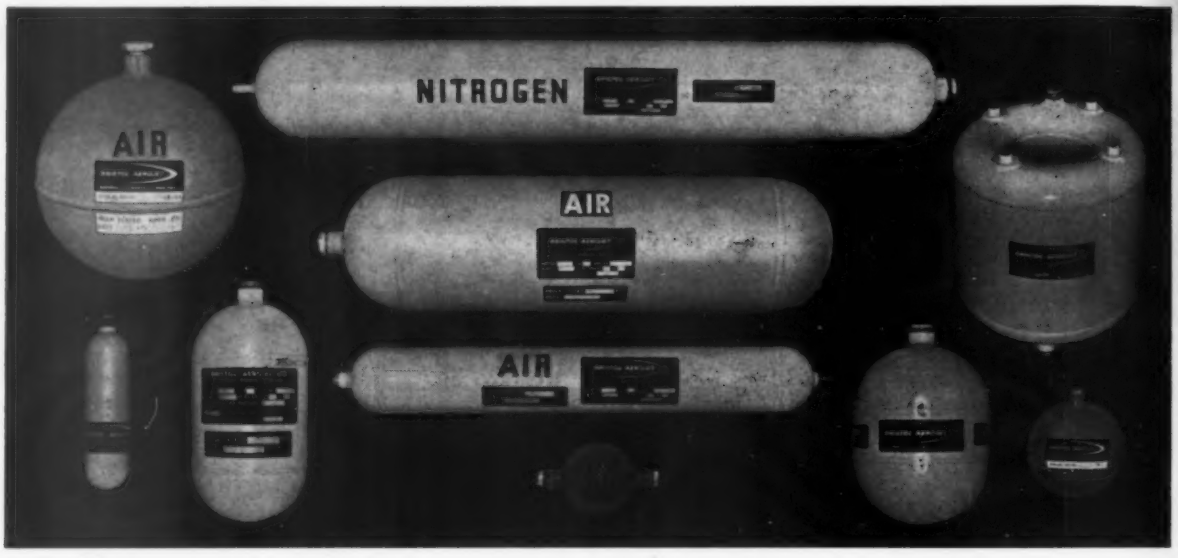

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Bristol Aerojet pressure vessels have been specially designed to operate with great reliability at high stress levels. Made of chrome molybdenum steel, heat treated to a minimum ultimate tensile strength of 80 tons per sq in, these vessels have been approved for service under ARB conditions.

Bristol Aerojet pressure vessels range from 10 to 2,000-cu-in capacity and are produced in a number of shapes to conform to special applications. They have been ordered by the leading UK airframe and weapon constructors, and also the main auxiliary equipment manufacturers, *for they pack more energy into less space for less weight than any other type of gas storage vessel.*

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Wallis-Bensen Gyro-Copter

Boeing-Vertol 107

Boeing-Vertol Chinook

Brantly B-2

VTOL INTERNATIONAL SURVEY

type fold-up seats, which will permit passengers to embark and debark without inconvenience to their fellow passengers. The mock-up simulates the full-size Vertol 107 cabin—6ft high, 32ft 6in long and 6ft 7in wide—and shows the standard Boeing Vertol 107 airline configuration of 25 seats. Furnishings are in various shades of blue in combination with neutral and sunburst orange—the colour scheme of New York Airways. . . . The interior makes use of the washable vinyl-aluminium laminated panels familiar to travellers in the Boeing 707s. Panels are perforated to absorb sound. Covering the floor is heavy duty fibre carpet, with three shades of blue running horizontally across the cabin. The theatre-type seats make for easy entry and exit, and can be folded along the cabin wall for increased cargo space. . . . The 'picture windows' consist of two panes of Plexiglas. The outer pane is clear, and the inner pane is tinted grey to cut glare to a minimum and make shades or curtains unnecessary . . ."

● Rotor diam, 50ft; fuselage length, 44ft 7in; empty weight, 9,298lb; gross weight, 18,450lb; max speed, 162 m.p.h.; cruising speed, 149 m.p.h.; vertical rate of climb, 1,240ft/min; hovering ceiling in ground effect, 7,800ft; service ceiling, 13,700ft.

Model 76 An accompanying photograph shows this turbine-powered tilt-wing VTOL research aircraft in developed form. A Lycoming YT53-L-1 drives two propeller/rotors on the tilting wing, and there are ducted fans in the tail section for additional control.

GETOL vehicle A photograph herewith shows a model of a projected GETOL (ground effect take-off and landing) vehicle which will use the ground effect phenomenon as a means of supporting itself on take-off and landing, while in flight it will use its wing for aerodynamic lift.

Brantly Helicopter Corporation

124 Maplewood Avenue, Philadelphia 44, Pa.

B-2 Claimed to be America's lowest priced helicopter designed specifically for civilian use, the B-2 side-by-side two-seater is powered with a Lycoming VO-360-A1A engine of 180 h.p. In the rear fuselage is a baggage compartment of 6 cu ft. Blade construction is interesting in that Polyeurathene is used in conjunction with an aluminium skin and an extruded aluminium leading-edge spar. View is exceptionally good and, as the photograph shows, the aircraft is of trim appearance.

● Rotor diam, 23ft 9in; empty weight, 980lb; gross weight, 1,600lb; max speed, 100 m.p.h.; rate of climb at s.l., 1,580ft/min; service ceiling, 11,400ft; rate of descent in autorotation at s.l., 1,400ft/min; range, up to 300 miles.

Cessna Aircraft Company

Wichita, Kansas

Skyhook Known as the Skyhook, the current model of Cessna helicopter is a four-seater utility aircraft priced at $79,960 (£28,500). The engine is a Continental FSO-526A of 270 h.p. It is claimed by the makers that the Skyhook embodies capabilities previously unavailable in light rotary-wing vehicles. Significant, they say, is the aircraft's stability, comparable to that of fixed-wing aircraft, which greatly simplifies handling. An exclusive feature is the patented maximum-airspeed indicator. The pilot simply adjusts the indicator for the gross weight of the aircraft at his particular altitude and a movable red line automatically indicates maximum speed for existing operating conditions. The cabin is said to have the largest area of any in the four-seater rotary-wing range, and luxurious executive interior schemes are available.

● Rotor diam. 35ft; fuselage length, 29ft 5in; empty weight, 2,080lb; gross weight, 3,100lb; cruising speed, 90-120 m.p.h.; hovering ceiling in ground effect, 9,600ft; range (normal fuel), 260 miles.

de Lackner Helicopters Inc

Mount Vernon, New York

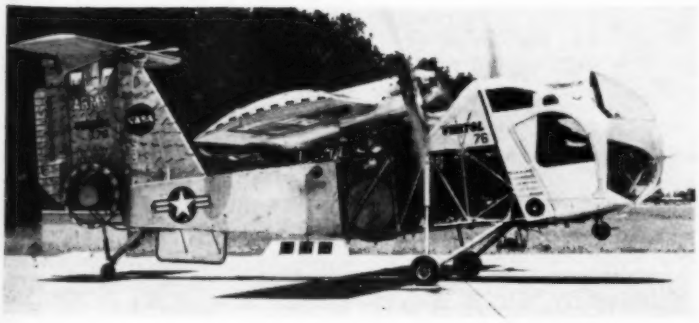
DH-5 Aerocycle Powered with a 40 h.p. Kiekhaefer Mercury Mk 55, this tiny helicopter has a platform upon which the pilot stands, controlling the craft by inclining his body. Empty and gross weights are, respectively, 220lb and 430lb. Our contemporary *Aviation Week* reports that several are "on bailment to universities."

Del Mar Engineering Laboratories

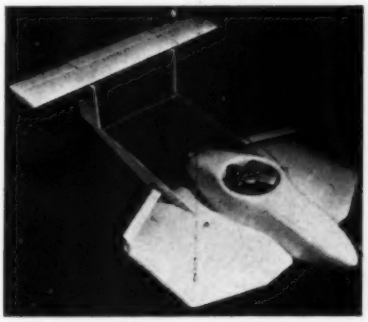
Los Angeles, California

Whirlymite Del Mar have entered the light helicopter field with the Whirlymite family of small manned and drone helicopters. The manned version, depicted, has completed fifty hours of flight testing. At present it is powered by a modified 6-cylinder Kiekhaefer Mercury outboard engine, though a gas turbine is available as an alternative and will allow increased payload and performance. To the basic helicopter

Boeing-Vertol Model 76



Model of Boeing-Vertol GETOL



Cessna Skyhook

Doak Model 16

Del Mar DH-1A

VTOL INTERNATIONAL SURVEY

elements specialized fuselages may be attached, making it possible for one basic aircraft to be used for a wide variety of applications. One such application is seen in the recently completed primary ground trainer, embodying the basic helicopter and a special ground effect platform. When the engine is on an air cushion is produced allowing the platform to move freely in any direction. The helicopter is attached through a simple ball joint and scissors mechanism which enables it to rotate in azimuth, move up or down vertically, and tilt in any desired direction.

Doak Aircraft Co Inc

Torrance, California

Model 16 Comparatively little information is available on this VTOL/STOL research aircraft, the military designation of which is VZ-4DA. The engine is a Lycoming YT53 of 840 s.h.p. and provision is made for a pilot and an observer. Ducted fans at the wing-tips can be rotated through 90° and can function as helicopter rotors for vertical take-off and landing and hovering. At a safe height after take-off the ducts are rotated to a forward-facing attitude making possible much higher cruising speeds than achieved by conventional helicopters (a maximum of 230 m.p.h. is reported). The engine is fitted with a long tailpipe and horizontal and vertical vanes are hinged at the jet efflux to assist control during low speed and vertical flight. The ducted fans and portions of the fuselage are fabricated from Fiberglas.

● Span, 25ft 6in; length, 31ft.

Gyrodyne YRON-1

Doman Helicopters Inc

Danbury, Connecticut

D-10 Powered with a Lycoming ISO-720 engine of 400 h.p., this is a development of the Doman LZ-5-2 described in previous issues. In the absence of new information from the makers we quote a report of a member of *Flight's* staff who flew in the earlier machine: "Perhaps the most attractive feature is the totally enclosed self-lubricating rotor hub, mounting the four hingeless blades; control is effected by tilting the gimbal-mounted rotor-head. The six passengers occupy seats angled out towards the sizeable windows, and with seats removed the concertina doors on each side fold to give a completely unrestricted access for large items of cargo. The eight-cylinder Lycoming engine is inclined low in the nose, and drives via a shaft passing between the pilots up to the rotor-head. In the air the LZ-5 demonstrated great tractability, with sufficient reserve from an engine of only 400 h.p."

The D-10 is being built in Palermo, Sicily, under the designation Doman Ambrosini D-10A. The suffix "A" denotes that the engine is the Lycoming IO-720 instead of the supercharged ISO-720. The following data apply to the D-10 model.

● Rotor diam, 48ft; length, 58ft 6in; height, 10ft 6in; empty weight, 3,327lb; gross weight, 5,500lb; max speed, 104 m.p.h.

Fairchild Engine & Airplane Corporation

Hagerstown, Marylard

M-224-1 Known to the US Army as the VZ-5FA, this experimental VTOL aircraft employs the deflected slipstream technique to a remarkable extent. The action of the special flaps can be seen in the picture. A General Electric YT58 shaft turbine of 1,204 h.p. drives the four propellers. Gross weight for VTOL testing is about 4,000lb.

Gyrodyne Company of America Inc

St. James, Long Island, N.Y.

YRON-1 Rotorcycle The Rotorcycle is being evaluated by the US Marines for the many tactical uses of which it is capable, e.g., liaison, reconnaissance, photography, mine detection, wire-laying and re-supply. It incorporates a co-axial rotor system claimed to give it outstanding flying qualities in all regimes of flight and to reduce pilot-training time by virtue of the relative simplicity of the pilot's task. The engine is a Porsche GP-702 delivering 72 h.p. Under US Navy contract the Rotorcycle has been equipped with automatic stabilization and remote control equipment to permit operation as a drone, controlled from a ground station. Discussions have been opened with the FAA regarding certification for commercial use.

● Rotor diam, 17ft; fuselage length, 11ft; empty weight, 550lb; gross weight, 832lb; cruising speed, 59 m.p.h.; max speed, 78 m.p.h.; max endurance 0.93hr; vertical rate of climb, 910ft/min; hovering ceiling in ground effect, 7,300ft; service ceiling, 12,400ft; max range, 48 n.m.

Hiller Aircraft Corporation

Palo Alto, California

12E The Model 12E for 1961, which has an earlier military counterpart in the H-23D Raven, is described as the most powerful helicopter in the light utility class. Dual carburetters are standard and in conjunction with high-compression pistons raise the power of the Lycoming VO-540 engine to

Doman LZ-5

Fairchild VZ-5FA

Hiller 12E

340 h.p. Accessories include floats; twin cargo racks with quick-release fittings; quick-release cargo hook; complete hydraulic rescue hoist; spraying gear; dual controls; night lighting equipment (including two revolving beacons); cabin heater and defroster; main rotor brake; special cabin interiors and soundproofing.

● Rotor diam, 35ft 5in; length, 40ft 6in; cruising speed, 90 m.p.h.; hovering ceiling in ground effect, 10,000ft; rate of climb at s.l., 1,340ft/min; service ceiling, 15,600ft; endurance, 3.2hr.

E4 This is a four-seater which can be obtained either brand-new or as a kit conversion of the three-seater 12E. Soundproofed interiors are available for executive versions.

YROE-1 Rotorcycle The Hiller company state that the type represents the minimum practical size in helicopters. It achieves a gross-to-empty weight ratio of about two—claimed to be a value unprecedented in mechanically driven helicopters. The engine is now a Porsche of 62 h.p., developed specifically for the aircraft. Primarily the YROE-1 is being developed for military applications, although a civil version is in prospect. A licence is held by Helicop-Air of Paris, and a batch has been constructed by Westland's Saunders-Roe division.

X-18 The characteristics of this tilt-wing research aircraft are seen in the photograph.

Hiller X-18

Hiller YROE-I

Two Allison YT40-A-14 engines each of 5,850 h.p. drive contra-rotating propellers which for take-off function in the manner of helicopter rotors. At low forward speeds control in pitch is provided by air ducts at the tail fed by a Westinghouse J34 turbojet.

● Span, 48ft; gross weight, 33,000lb; max speed, 250 m.p.h.

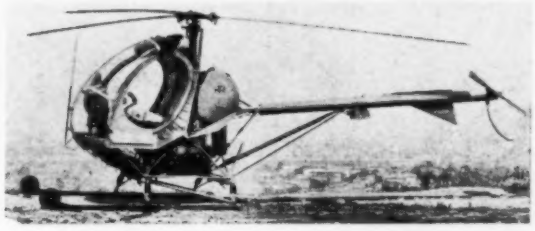
Hughes Tool Company

Culver City, California

Model 269A The makers claim that this helicopter requires half an hour of maintenance per flight-hour, uses 8-10 US gal of fuel per flight-hour, and gives at least 1,000hr life for all wearing parts in all major components. The Lycoming O-360 engine of 180 h.p. is installed beneath the two seats, and a vee-belt drive eliminates the need for a clutch.

● Rotor diam, 25ft; length, 28ft; empty weight, 867lb; gross weight, 1,550lb; cruising speed, 85 m.p.h.; hovering ceiling in ground effect, 6,000-13,500ft; range, 200-220 miles.

Hughes Model 269A



(Below) Kaman Seasprite

Kaman Aircraft Corporation

Bloomfield, Connecticut

H-43B Huskie Powered with a Lycoming T53 turbine of 825 s.h.p., the Huskie is primarily intended for crash-rescue. It features several well-known Kaman developments, including servo-flaps, intermeshing rotors, and in-flight tracking. Servo-flaps are small aileron-like controls mounted behind the rotary wings. They make

Hiller E4

possible lighter, more sensitive control as well as greater stability. The intermeshing rotors permit a symmetrical design in which torque is inherently equalized and balanced. All of the power of the engine can be translated into lift. In-flight tracking is a Kaman-developed system that enables the pilot to track either rotor by a simple switch in the cockpit.

● Rotor diam, 47ft; length, 47ft; empty weight, 4,500lb; gross weight, 9,150lb; max speed, 129 m.p.h.; normal still-air range, 250 miles.

HU2K-1 Seasprite A naval utility helicopter powered with a General Electric T58-GE-6 gas turbine of 1,050 s.h.p., the Seasprite has a retractable undercarriage which is intended not only to benefit speed but to avoid the possibility of the cable being entangled on rescue operations. In addition to the crew of two up to 13 passengers or four stretcher cases can be carried. The manufacturers have developed their own automatic stabilization equipment and dead-reckoning navigation equipment for this helicopter in order to provide maximum flexibility in rescue work, all-weather operation and anti-submarine warfare. When coupled, the autostabilization equipment and "autonavigator" provide complete hands-off control.

● Rotor diam, 44ft; length, 52ft 2in; weight empty, 5,052lb; gross weight, 9,152lb.

McDonnell Aircraft Corporation

St Louis, Missouri

Model 120 The Model 120 is being developed as a cargo helicopter and is unusual in having three compressors—AiResearch GTC-85-35s—which supply compressed air to pressure jets at the tips of the three rotor blades. Flight can be maintained at gross weight with one engine inoperative. Cargo is carried suspended from a pilot-controlled hook immediately below the rotor and twelve people can be accommodated on "toboggan seats" which attach to the cross-member supporting the cockpit and a similar aft member which is a part of a "personnel kit." This kit will contain an enclosure to protect the occupants from wind and downwash. The use of turbine compressors as the source of power permit take-off within 40sec of the pilot entering the cockpit.

● Empty weight, 2,400lb; gross weight, 6,300lb; range, 80 miles.

Piasecki Aircraft Corporation

International Airport, Philadelphia 42, Pa

VZ-8P Sky Car One of a number of Piasecki research vehicles, the Sky Car has a 425 h.p. Turboméca Artouste 2B shaft turbine. The single passenger is seated between two ducted fans arranged in tandem. A larger development is being built, powered with two Artouste 2Cs.

Sikorsky Aircraft, Division of United Aircraft Corporation

Stratford, Connecticut

S-60 Skycrane The existing version of the Skycrane—a joint project with the US Navy—is a research and demonstration vehicle powered by two Pratt & Whitney R-2800 piston engines and having a lifting capacity of five tons. Future aircraft of this family will be turbine-powered and will have lifting capacities ranging from eight to 40 tons. The makers describe the Skycrane as a "prime mover," the aerial equivalent of a railway locomotive. There is no conventional passenger or cargo cabin, but the load is carried externally on a hoist or sling attached to four strong points. The pilot's seat can be reversed to face rearward and a duplicate set of controls enables him to operate the winch or watch the loading and unloading operations. An experimental "people pod" detachable unit carrying 20 persons with "complete lack of vibration" has been developed.

● Rotor diam, 72ft; gross weight, 31,200lb.

HSS-2 Claimed to be the world's largest amphibious helicopter, the HSS-2 has a flying-boat hull and is powered by two General Electric T58-8 turbines of 1,250 s.h.p. each. It is in production for the US Navy as an anti-submarine warfare weapon system and will be the Navy's first all-weather helicopter. The makers state that it also gives the Navy its first helicopter "that can search out and destroy enemy submarines." The aircraft can alight and take off from water in an emergency, and it has the capability to take off, land or fly on a single engine at low gross weights.

● Rotor diam, 62ft; fuselage length, 54ft 9in; empty weight, 10,854lb; gross weight, 17,300lb; max speed, 149 m.p.h.; best rate of climb at s.l., 1,780ft/min; range with 10 per cent reserve, 580 miles.

McDonnell Model 120

Sikorsky S-60

VTOL INTERNATIONAL SURVEY

S-61L This is a commercial helicopter carrying from 25-28 passengers. It has "the capability to continue flight to normal landing areas with one engine inoperative." The hull can be sealed to give the aircraft amphibious capability and to permit it to operate from land, water, snow, ice, or almost any other surface. The S-61L uses the major mechanical components, the main rotor head, and rotor blades of the HSS-2.

● Rotor diam. 62ft; fuselage length, 58ft 11in; weight empty, 9,270lb; gross weight, 18,700lb; max speed, 147 m.p.h.; typical cruising speed, 136 m.p.h.; best rate of climb at s.l., 1,600ft/min; range with max fuel, 350 miles.

S-62 The S-62 is the first American turbine-powered helicopter to be certificated by the Federal Aviation Agency for commercial operation. It is also the first helicopter of any type to be certificated under the FAA's new helicopter transport regulations which are far more stringent than previous requirements. The FAA certificate permits the aircraft to carry a pilot, co-pilot and 11 passengers. The first helicopter to have a flying-boat hull, the S-62 can operate from most types of surface. The makers further state: "The S-62 is the first helicopter in history to fly from the start with proven mechanical components having extended overhaul periods. This was accomplished under the Sikorsky building block concept of blending a new airframe and a modern gas turbine powerplant with the mechanical components of the time-tested Sikorsky S-55. The S-55 has mechanical components proved in world-wide operations during more than 1,200,000 flight hours and the almost 1,300 helicopters of this type manufactured during the past 11 years." The engine is a General Electric CT58-100-1 of 1,050 s.h.p. derated to 670 s.h.p.

● Rotor diam. 53ft; fuselage length, 44ft 7in; empty weight, 4,789lb; gross weight, 7,500lb; cruising speed, 98 m.p.h.; best rate of climb at s.l., 1,380ft/min; range with normal fuel, 270 miles.

S-64 A forthcoming member of the Skycrane family, the S-64 is described as an all-purpose transport and flying crane. A series of detachable pods, designed and equipped to give the best possible performance, is being developed, and an important application foreseen is that of aerial tug. The makers particularly draw attention to the aft-facing pilot's seat and flight controls, offering direct rear vision for pilot-command of loading and towing operations; the 9ft unobstructed loading area; the undercarriage, which is hydraulically shortened or extended to facilitate load pick-ups and to eliminate the need for extra ground-loading equipment; attachment points on both the fuselage and undercarriage permitting almost any conceivable shape of load to be secured; and the "load stabilizer" which prevents undue sway in cargo winching operations.

The engines are Pratt & Whitney JFTD12A-2 turbines delivering 4,050 s.h.p. each (military rating) and they drive a six-blade rotor.

● Rotor diam, 72ft; overall length (blades extended), 87ft 6in; empty weight, 17,240lb; gross weight, 38,000lb; cruising speed, 109 m.p.h.; vertical rate of climb at s.l., 800ft/min; hovering ceiling out of ground effect, 6,000ft; max range (two engines), 200 n.m.; max range (single engine), 800 n.m.

Umbaugh Aircraft Corporation

Hagerstown, Maryland

Umbaugh 18 This autogyro, now in large-scale production, has been designed to sell for $9,995 (£3,569). The makers state that the Fairchild Engine & Airplane Corporation has sub-contracted to build 10,000. A Lycoming 180 h.p. engine drives a pusher propeller, necessitating the use of a low-set boom, which carries a tailplane and three vertical surfaces. The two occupants sit in tandem and have dual controls. The three-blade rotor can be pre-rotated for jump starts (the makers state, "Simply push a button and take off!"). Construction is all metal and there is 6 cu ft of baggage space. The aircraft can be adapted for crop-dusting and spraying and will be available with floats.

● Rotor diam, 35ft; gross weight, 1,800lb; cruising speed (65 per cent power), 100 m.p.h.; service ceiling, 15,000ft; range, 350 miles.

Piasecki VZ-8P

Sikorsky S-62

Sikorsky HSS-2

Umbaugh Model 18

Sikorsky S-61L

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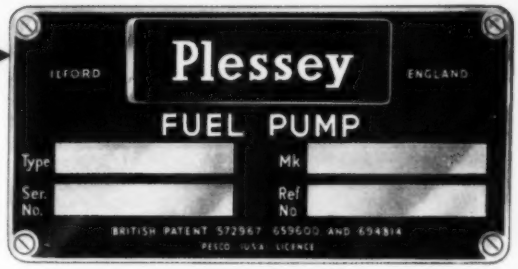

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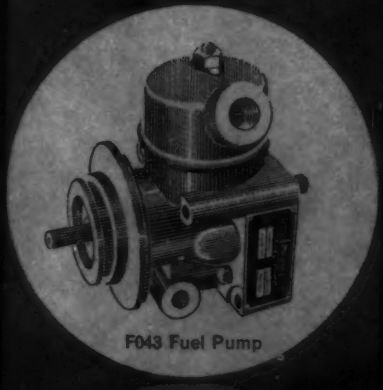
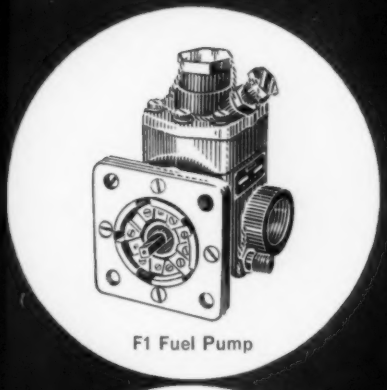
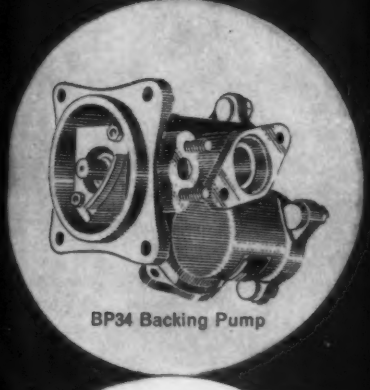
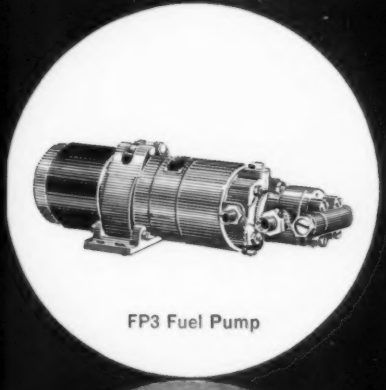
BP200 Backing Pump

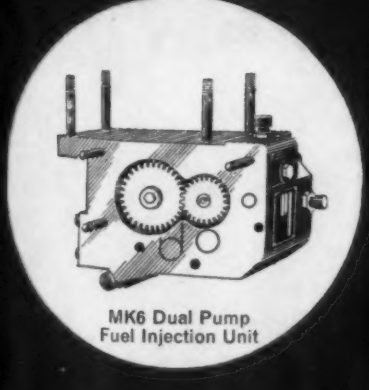

F043 Fuel Pump


F1 Fuel Pump


BP34 Backing Pump

GP078 Governor Pump


FP3 Fuel Pump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Straight and Level

THERE, in his accustomed corner in the Air Power Club smoking room, was my old friend Sir Charles Boost, chairman of Plummet Air Lines. He was looking fit, after his annual tour of Plummet's far-flung network of international routes, a trip he makes each year in his famous yacht *Supersonic Brochure*.

"Ah, laddie, let me get you a drink," he said, dismissing his press officer with a curt nod. "Just the chap I wanted to see! What do you think of this, eh?"

Out of a secret drawer in his flying helmet he produced the biggest political pamphlet I have ever seen, entitled *Drains to the Corporations*. "It's only a draft, but it"ll give you an idea of how we intend to persuade the Air Transport Licensing Board to grant our six hundred-odd applications for new route licences. Have another drink."

The document was so lengthy that I had to ask the barman for the use of BEDSTEAD*, the Club's reading simulator, a recent gift from Thinx Electronics Ltd. In a flash Bedstead produced a summary for me: "BEA and BOAC are dogs in the manager, flabby, fat, inefficient, subsidized, useless, hopeless, terrible, ghastly and lousy; moreover their stewardesses are frightful compared with Plummet's, though the nicest one of all works for British United Airways. Therefore, all BOAC and BEA routes should at once be shared with Plummet. As a concession on its part, Plummet will agree to a pool agreement with BOAC and BEA, in order to defeat the whole object of the Civil Aviation Licensing Act, 1960."

"How about that, eh, laddie? Good stuff? Smack in the Minister's cake-hole, eh? Have another drink."

* Busy Executives' Device for Sifting Endless Aviation Documents.

I hope the Minister of Defence, Mr Harold Watkinson, will not think me too disrespectful for showing you this picture of him at a press conference. He was actually talking about Skybolt, and when you talk about Skybolt the calendar is one of those things you've very much got to take into account

● **PONY EXPRESS ATTACKED BY NUCLEAR SUB**

—heading to Admiralty news release.

You never quite know just where these things are going to pop up, whether from under the ice-cap or in the middle of cowboy country. In this case, USS *Sargo* was doing battle with SEATO forces in a Far East exercise called "Pony Express."

It's really wonderful what warships will do these days. I like this from a *Daily Express* story about the aircraft carrier HMS *Hermes*:—

"Hermes, with 190 officers and 1,644 men, has a summer programme to carry out before her refit. She will attend the Paris Air Show, and then return to Portsmouth."

● *"Under the new regime the 'postural, strategic and tactical value' of a given weapons system will come in for closer scrutiny than previously."*—US Department of Defense.

As you know, Straight and Level has a posture—especially in relation to the Americans' obsession with the word posture. Now they put it in adjectival form—postural. Watch out, folks, for the verb form, slated for expedited rollout—posturalize. Then for the noun, posturalization, followed by the adjective posturalizational, and then the verb posturalizationalize.

● "The giant Amalgamated Engineering Union yesterday claimed . . . reduction from 42 to 40 hours in the working week, without loss of pay."—*Daily Mail*, London, April 27.

"Latest signs of a growing impatience with the relative US position in space exploration includes agitation . . . for a longer work week—44hr at first, and later 48hr."—*Aviation Week*, New York, April 24.

● It strikes me as high time that the people engaged in the space-race agreed on a system for calculating payloads. Both the US and Soviet Union have given detailed figures for weights placed in orbit, but have carefully failed to explain what these weights mean. Saturn, for example, by far the most capable launcher in prospect in America, is said to be designed to put 20,000lb into low Earth orbit, and accelerate a 6,000lb payload to escape velocity. But do these weights include structure, final-stage propulsion and residual fuel? The Russians have been very careful to say exactly how they define their payload weight, and an internationally understood system is overdue.

How odd if the payload quoted for an airliner might, or might not, include the weight of the fuselage.

"Big clubhouse they've got here, Fred"

● Do you remember my quotation the other week, which I attributed to Benjamin Franklin: "Of what use is a new-born babe?" The Editor tells me it was Faraday, and would I please be not quite so ill-read in future.

● BEA and their associates in the Mediterranean and Middle East, Cyprus Airways and Olympic Airways, are jointly advertising in Beirut that their Comets are "THE FASTEST COMETS IN THE WORLD."

Faster than the Comets operated by BOAC and *their* associates, MEA, that means. Faster because they were designed for shorter hauls. Thinks: What are BEA doing competing with BOAC Comets anyway?

Don't Miss This

● From a radio propagation conference programme at Boulder, Colorado, July 31-August 18: *"August 7-18 session, Paper 22: Auroral and Quasi-Incoherent (Thompson) Scattering, by R. S. Cohen."*

ROGER BACON

Procaer's F.15 Picchio (180 h.p. Lycoming), subject of a flight report in last week's issue, is in the classic tradition of Italian sports aircraft, which are discussed on this page "Flight" photograph

Sport and Business

LIGHT AIRCRAFT IN ITALY have, until now, generally been produced in hand-made batches and a total of only 43 touring aircraft were made during 1959. This figure may have been slightly better during 1960, but the large manufacturers such as Fiat and Piaggio have not entered the light-aircraft field, if one excepts the P.166, which is rather out of this category. The situation is now changing, however, and several true production projects can be expected during 1961.

SIAI Marchetti, a major industrial concern, has hitherto concentrated on repair and overhaul of military liaison and transport aircraft, but the company's new president is a keen pilot and has launched production of the former Nardi FN.333 Riviera amphibian (*Flight*, February 17) for sale in the USA and then abroad generally. There is also a possibility that Marchetti will design an all-metal land-plane with characteristics similar to those of the Piper Cherokee.

Another large company is Caproni, of Trento, the aviation section of which is called Aeromere. It is already well known for its production of the Falco F.8L America—the British agent is Mr J. L. Shaw, 22 Rawson Rd, Bradford—and this type it will continue to produce in fair numbers during the current year. But Aeromere has a considerable work-force, good installations and a large private airfield and it seems very likely that the company will at a later date design and produce a light, all-metal aircraft—a simplified, all-metal Falco has been mentioned.

The third large company in the light-aircraft field is Macchi, which is already preparing for licence production of the Lockheed Santa Maria utility aircraft. The first Lockheed-built prototype was recently sent to Lockheed-Azcarate in Mexico, where it will also be produced, and Continental fitted a supercharged engine during recent months. Present production from the three Italian companies is far below their actual capacity and any large-scale light-aircraft venture will almost certainly come from one of them.

In what might be termed the hand-built aircraft field, Italy has already gained a considerable reputation by the work of Aviamilano, Procaer, Partenavia and Meteor. The last-named has also recently begun manufacture of both airframes and engines for a group of target drones for the Italian Services. Some time ago the Italian Aero Club, attempting to break a near-paralysis in club flying, ran a competition for a light trainer which would be sold to the clubs with government subsidy. Some of the specifications, such as maximum wing-loading of only 9.2lb/sq ft, were a little unrealistic. Such a wing-loading hardly helps in preparing a pilot for aircraft like the Debonair, Bonanza, Cessna or Comanche: many consider that a maximum of 13.3lb/sq ft would have been acceptable, particularly in view of the fact that safety no longer depends so closely upon wing-loading, or even upon a very low stalling speed.

Two Italian companies produced designs for the competition and both were accepted. They were the Aviamilano P.19 with a low wing and the Partenavia P.59 with a high wing. Large numbers of orders were received from the clubs, particularly for the P.19, and Aviamilano have accordingly slowed down Nibbio production—a batch of five only is now in hand—and are working on a batch of 50 P.19s. This type was described in *Flight* of January 13. Partenavia are building a few P.57 high-wing three/four-seaters and one P.59 has been made. It is probable that, as a result of the Italian Aero Club competition, the Macchi 308s and Meteor FL.3s which now form the backbone of the club fleets will be replaced by the P.19 and P.59, but export prospects for these types seem remote.

ITALIAN LIGHT AIRCRAFT (SINGLE-ENGINED)

Maker	Type	Engine	Wing area (sq ft)	Weight (lb) empty	Weight (lb) gross	Seats	Max speed (m.p.h.)	No to be built	Price
SIAI Marchetti	FN.333 amphibian	270 h.p. Continental	162	1,960	2,980	4	186	15	£10,350
Aviamilano	Nibbio F.14	180 h.p. Lycoming	140	1,570	2,540	4	202	5	6,040
Aviamilano	P.19	90 h.p. Continental	151	1,015	1,545	2	124	50	2,880
Aeromere	Falco F.8L America	150 h.p. Lycoming	106	1,135	1,720	2	205	20	4,700*
Procaer	Picchio F.15B	180 h.p. Lycoming	144	1,530	2,600	4	192	25	8,900*
Procaer	Cobra F.400	400 kg/p Turboméca Marboré	126	2,205	3,530	2	360	1	N.A.
Meteor	FL.53	65 h.p. Continental	151	795	1,260	2	102	0	2,300
(Not in production)	54	85-90 h.p. Continental							
	55	130-150 h.p. Continental							
Partenavia	P.59	90 h.p. Continental	156	1,060	1,570	2	121	1	2,880

* UK prices. Agents are J. L. Shaw, 22 Rawson Road, Bradford (Aeromere) and Maxfield Aviation Co Ltd, 66 Pembroke Road, London W8 (Procaer)

Procaer did not take part in the competition and is concentrating on production of the F.15 Picchio and development of the turbojet-powered Cobra F.400. Both these types have the novel bonded plywood and aluminium skin. Following the prototype, five three-seat Picchios with the 160 h.p. Lycoming engine and ten four-seaters with 180 h.p. engines have been completed and sold both in Italy and abroad. Currently a batch of 25 more Picchios with certain important modifications is in production; and these will represent the definitive version. The prototype Cobra, powered by a Turboméca Marboré, is now being flight-tested by the well-known French test pilot Pierre Bonneau.

The accompanying table gives relevant data on the present range of Italian single-engined light aircraft.

Home-designed and home-built, the two-seat Baladin, powered by a 90 h.p. Continental, is now flying. It is the work of Maurice Paumier of Paris, a florist and flying instructor

Skyscooter is the name of this new compact autogiro, available in kit form from Saalfeld Aircraft Co, P.O. Box 84, San Diego, California. Level-flight speed range is 25-85 m.p.h. and empty weight is 275lb

AIR RACING AND COMPETITION TROPHIES for 1961 will include the John Morgan Challenge Trophy for the London - Cardiff race on June 2. Winners of the three class races at Cardiff on June 3 will receive respectively the Air League Cup, Norton-Griffiths Trophy and DH Tiger Moth Trophy. At the Baginton meeting on July 13-15 the race for the King's Cup will be held—with foreign-built aircraft, British-registered, participating for the first time—and the SBAC Cup will go to the pilot making the fastest speed over the King's Cup course. On July 27-29 the Royal Aero Club is organizing its international Business and Touring Aircraft Competition, at which the awards will include the Royal Aero Club Diamond Jubilee Trophy, McAlpine Cup, Osram Cup and Beagle Cup.

SOUTHERN AERO CLUB, Shoreham, are to honour chief flying instructor Cecil L. Pashley at a party and presentation on Saturday next, May 13, to mark his 70th birthday and completion of 50 years' active flying. With over 18,000 hours in his logbook, Mr Pashley has been appointed MBE and awarded the AFC and the Royal Aero Club's Silver Medal for his services to aviation.

Cessna 185 Skywagon (260 h.p. Continental) fitted with new 21.5 cu ft glass-fibre "Cargo-Pack" pod has a maximum speed of 170 m.p.h.

HALPIN'S NEW MF AND VOR BEARING INDICATOR, called ADAS, has now been submitted to the MoA for approval and last week *Flight* was able to fly a Cessna 170B in which the prototype equipment is being carried. Preliminary details of ADAS were given on page 598 last week. During our visit only the MF portion of the equipment was in operation, consisting of a transistorized power pack feeding the miniaturized MF receiver and 2in cathode-ray tube indicator. Reception was through a normal sense aerial and a Brooks and Gatehouse Homer ferrite aerial in fixed mounting above the cabin.

Because the aerial had to be tuned, but was inaccessible from the cabin, Hythe (Southampton Water) NDB, which is very low-powered, was tuned before take-off and no other beacon used. The c.r.t. warmed up very quickly and was aurally identified in the normal way by earphones plugged into the combined station box and MF/VOR selector. Selecting the first position on a selector switch next to the c.r.t. caused a flat "blip" to appear on the scope. This "sprouted" sideways as the morse identification came through and gave positive visual identification. Earphones are therefore not absolutely necessary when using ADAS. Additional knobs beside the c.r.t. allow the trace to be moved across or up and down on the scope to put signals in a convenient position for viewing.

Having identified the beacon, we turned the selector to the sense position, whereupon a plain dot appeared on the c.r.t. Depression of a spring-loaded switch on the receiver then caused the dot to swing downwards if the beacon was behind us or upwards if it was ahead—positive and unequivocal indication of the general direction of the beacon. Finally the selector was moved to "direction" and two dots appeared one above the other on the screen. The aircraft was turned until the dots approached as closely as possible to each other, almost overlapping. This denoted the heading to or from the beacon, according to the sense indication.

In the air, *Flight's* representative was flown to the Winchester area and told to switch on ADAS and fly to Hythe beacon. Identification and sensing operations proved simple, and the inbound heading was soon established without looking outside the cockpit and with DI caged and compass covered up. Repeated turns off the heading showed that the on-course relationship of the dots covered an arc of about 20° and that precise headings ought to be difficult to find. Nevertheless the Cessna passed almost directly over the beacon—a fact which was positively indicated when the lower dot fell right away from the upper one for a while before returning to the on-course position. The sense indication, when the appropriate switch was pressed, also changed.

As the Cessna neared the beacon and the signal increased, the dots moved steadily towards the top of the display, giving some idea of range. Vertical position adjustment was needed because the dots travelled more than the height of the scope during the homing from about 10 miles away.

Immediately after passing the beacon it was almost impossible to notice an alteration in heading signal despite a turn of 360°, although positive sense indications remained. But the equipment was then slightly off tune. Throughout the homing, the identification morse signals remained as a separation of the homing dots in synchronism with the morse letters.

For VOR, a special lightweight receiver incorporating a comparator will be produced soon and the dots will deflect sideways, instead of up and down, to give left/right signals. The radial will be selected on a dial on the receiver. A VOR aerial will be required for this application.

Criticisms of this prototype equipment are that bearings can be taken only on the aircraft centre-line, and that sensitivity is too poor for really positive homing, particularly close to the beacon. A rotating aerial would overcome both these defects, even without some adjustment of the sensitivity. The aerial must obviously be tunable from inside the cabin. *Flight* found the presentation simple to use, combining a great deal of useful information in one display, without requiring earphones. If the complete equipment can indeed be marketed for under £200 it will be extremely useful and should sell well.

One hundred and ninth Auster design variant, but first of the new Beagles, the Beagle-Auster A109 Airedale four-seater costs £4,750 in standard form. Powered by a 180 h.p. Lycoming engine, this handsome newcomer to the British scene was fully described in our issue of May 4. First flight was on April 16, and first public appearance was at Baginton on April 27

"Flight" photograph

(Left) An engineer tests the rocking cockpit simulator made by Shorts precision engineering department for RAE (see first item). At right are the hydraulic controls for the electro-hydraulic servo system

FLIGHT SYSTEM SURVEY

Simulating the Rough Stuff

THE precision engineering division of Short Brothers and Harland Ltd at Belfast have completed a "rocking cockpit" simulator for RAE Bedford to allow simulation of handling characteristics in adverse conditions during high-speed flight. A strong framework supports a moving beam on which is mounted the cockpit, weighing 700lb with the pilot. Hydraulic rams can move the beam in roll and pitch while a third ram relieves the pitch servo of overhanging loads.

Roll freedom is 15° to either side and maximum rate of roll is 45°/sec. In pitch, the beam can be tilted 10° down or 20° up at a maximum rate of 25°/sec. Special damping devices at the travel limits prevent damage to the structure in case of rapid full deflections. The hydraulic servos are electrically controlled and a specially built analogue computer will supply demands corresponding to cross-winds, gusts and turbulence at various airspeeds. The pilot will be accommodated in a special cockpit unit to be provided by RAE and fitted after the simulator is installed at Bedford. He will have full controls and instrumentation and will be able to handle the simulator in difficult flying conditions.

Automatic Carrier Landing

FIRST operational installation of the Bell Aerosystems automatic carrier landing system will be on the new nuclear-powered US Navy carrier *Enterprise*. When this installation has been evaluated, nine other carriers will be fitted between late 1962 and 1964. They are *Constellation*, *Kitty Hawk*, *Independence*, *Ranger*, *Saratoga*, *Forrestal*, *Roosevelt*, *Coral Sea* and *Midway*. The Bell system employs tracking radar and a computer to detect the position of the aircraft relative to a pre-selected approach path and a VHF data link transmitting control demands to the autopilot. The human pilot may have to control the throttles, but allowance is made for movements of the carrier's deck.

Contribution to Polaris

DYNAMIC analysis equipment originally designed by Solartron Electronic Group Ltd, has been re-engineered to meet US Services specifications by Solartron Inc, in California, and now forms part of the standard Nortronics Dattico Mk III, which performs automatic check-out for Polaris missiles.

Solartron Inc was formed in 1956 to sell British Solartron equipment in the US and one successful item was the transfer function analyser. It was in 1960 that Solartron Inc began manufacture of special equipment, based on the transfer function analyser, for use with Polaris.

Score Series Test Equipment

THE Autotest division of Elliott Brothers (London) Ltd has designed electrical test equipment in unit form for use on production lines. Made up from Score units, the equipment can be bought in its basic form and expanded by stages to make up a comprehensive circuit testing facility. The basic unit is the Score 1 switching unit, with which continuity on up to 200 outlets may be tested. A pre-set version will also show a fault if continuity resistance exceeds a given value; and either numerical or printed indications show which line is faulty. Two Score 1 units will cover 400 lines or random testing between any two lines.

Score 2 is an insulation checker in which current may be applied for 0.1 sec or any desired test time, either between line and earth or between one line and any or all other lines. Score 3 is a resistance checker with various values and tolerances and is appropriately used with the Score 4 programmer. Either patchboard or magnetic tape programme may be used according to the type of testing carried out. A writing unit with press-button keys is incorporated in the magnetic tape unit. The last Score unit is the No 5 capacitance and inductance checker for testing effective impedance in circuits, no leakage tests being applied. Autotest have developed an entirely new relay which is to be incorporated in Score and all future automatic test equipment.

Radio for Western Australia

ONE of the most powerful radio stations in the world is to be built at Tolgarno, near North-West Cape, about 1,000 miles north of Perth. The radio, which will be American, will be able to communicate with submerged submarines and with aircraft almost anywhere in the world and will possibly be supplied with power by a small nuclear reactor. The project would cost several million dollars.

Zenith Portable for Navigation

THROUGH their United Kingdom agents, United Mercantile Co Ltd, of Sovereign House, Queen Street, London W1, Zenith Radio Corp are now marketing in Britain the Navigator transistor portable radio with which bearings can be taken on broadcast and MF navigation transmitters. Covering the 550-1,600kc/s and 150-400kc/s bands, the Navigator has eight transistors and will run for some 300 hr on small torch batteries. It weighs 5lb and has a "nav" setting which eliminates automatic volume control and gives sharp nulls for taking bearings. The ferrite rod aerial is within the container, and there is a small rotating bearing dial on top of the case. Price of the Navigator in Britain is £69 6s 11d.

At Kelvin Hughes' Barkingside factory, RCAF specialist radio and navigation officers on tour in Britain inspect air data computers for the Smiths flight control and instrument system for the DH Trident. This is the first published view of these components

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Constant-frequency Systems

IT would appear to me that the necessity for a complete constant-frequency a.c. electrical supply now currently being recommended and used on modern aircraft has been, to put it mildly, over-emphasized. There is no doubt in my view that the cost and weight, along with the complication of a constant-speed drive, with all its associated necessary protective control circuits, outweigh any possible advantages with such a system.

I feel that there is a lot to be said for a basic aircraft electrical generating system of "wild" frequency 208V a.c. which, over the normal *flight* operating speeds of jet engines, would not provide sufficient variation in frequency to preclude the use of a.c. induction motors for most services, such as control hydraulic motors, actuators, etc. The fairly considerable d.c. requirement still necessary on modern aircraft could then be catered for either by rectified a.c. to 112V d.c. or 28V d.c. or by the use of a brushless d.c. generator. The constant-frequency supplies—which, in fact, I understand only amount to about 10 per cent of the total electrical requirements of the aircraft—could be catered for either by rotating invertors or, if there is an objection to this due to brush troubles, transistorized invertors.

Apparently therefore we have to put up with a complete full-scale constant-frequency supply in order to keep the alternators all parallelled together.

I am aware that there might have to be automatic load-switching devices to cater for failures of individual alternators, but *only* for direct a.c. supplies.

A constant-frequency system is an electrician's paradise, but is it the most all-round efficient system for an aircraft? Anyhow, 400 c/s is the wrong frequency to have chosen as a higher frequency system; nearer 1,000 c/s would have been lighter.

I think it would be useful if some of our aircraft electrical engineers would be honest enough to set down the actual cost and weight of a constant-frequency system on an aircraft compared to the system I have outlined.

Derby H. E. WEST

Airliner Fleet Names

WITH reference to the letter in *Flight* of April 20 concerning airliner fleet names, the following may be of interest, especially to your correspondent Peter W. Moss. Last year I wrote to BOAC suggesting that their forthcoming Vickers VC10 airliners be named individually after holders of the Victoria Cross.

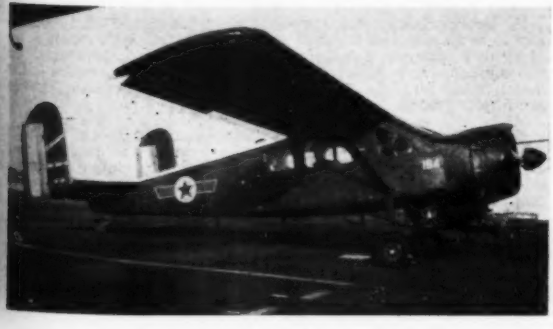
Despite the then chairman's reply to the effect that it was no longer corporation policy to name individual aircraft, I still feel that the introduction of these new airliners will present a most apt and unique opportunity of further perpetuating names of which this country can justly be proud. I would welcome comment on this idea.

Feltham, Middx ARTHUR W. SMITH

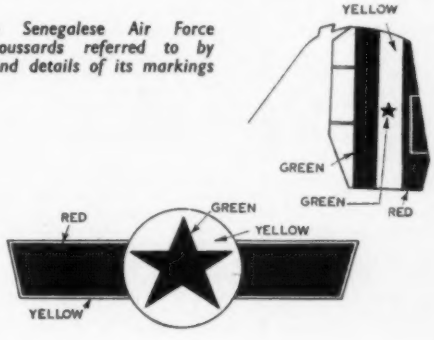
Senegalese Air Force Aircraft

I HAVE pleasure in sending you photographs [one of which is reproduced below—Ed] of the aircraft recently delivered from the French Air Force to the new Senegalese Air Force. Its main base is Dakar (Yoff) Airport, on the other side of the civil airport, along the parallel runway. Senegalese crews are being trained by the French for servicing the aircraft, but training will not be completed for a year. Equipment comprises six aircraft (two C-47s and four MH.1521M Broussards) and two helicopters (Bell 47G-2s).

Dakar, Senegal ROGER CARATINI



One of the Senegalese Air Force MH.1521M Broussards referred to by M. Caratini, and details of its markings



Airline Costing

READING Mr K. G. Wilkinson's fascinating letter [April 27] on his methods of arriving at aircraft operating costs, I was at once struck by the similarity between them and the methods of the organization of which I have the honour to be president, the International Confederation of Aeronautical Financial Geniuses, better known as ICAFG. Our methods of costing are recognized by airline accountants the world over, and differ from Mr Wilkinson's only in that, whereas he uses design seat-capacity (all cases adjusted to 100 seats at 34in pitch), we use fuel-tank capacity (US gal) multiplied by the nosewheel tyre-pressure (kg/cm²). Also, where he used design stage (adjusted to 1,000 statute miles), we use compressor stages (turbine engines), or supercharger stages multiplied by boost pressure (in Hg) (piston engines). In both cases, of course, results are corrected to ISA conditions. As regards the other interwoven sources of variation, we have a curve of s.f.c. against captain's coffee temperature, which we find most useful for unravelling such complexities. (Copies are available to non-members on cash payment of a fee of five guineas.)

The Confederation has recently conducted a survey similar to that carried out by Mr Wilkinson, using these methods, and the results are so nearly coincident with his that he is to be sincerely congratulated on obtaining such results without access to the ICAFG formulae.

With regard to the letter published together with Mr Wilkinson's, Mr Rew appears to be rather ill-informed as to the multifarious variables used in airline costing. "Profits in real money" indeed; that, with all respect to Mr Rew, is typical of the technician's unrealistic attitude towards airline finance.

Nr Princeton, Devon A. FIDDLER.

Short-range Forecast

I DESIRE to put in an appeal for the use of astrology in the determination of flying deliberations, such as the drawing-up of schedules, prospects for individual flights, air fêtes, sports days, times for test flights or prototypes, etc, day and hour for a first solo flight, also for assessing the pros and cons of aircrews, test pilots and pupils by candid, expert examination of their individual birth data.

I would first like to point out, immediately, two wretched days in the very near future not fit to see any aircraft in the air. They are: *Saturday, May 13, and Sunday, May 14, next.*

I hope that one day there will be daily and nightly astrological forecasts for flying. For years I have noticed that aircraft mishaps predominate on days which, according to astrological judgment, were not fit for joy-rides, let alone payloads. After the morning of February 15 last both the Sun and Moon were in opposition to Uranus (as seen from the Earth), signifying undue danger to flight operations, because at that time, according to astrological interpretation and my own experience, the human element would be at fault. On that morning an airliner crashed at Brussels with the loss of 73 lives. No aeroplane would normally have been on the wing at that hour had Administration been astrologically conscious.

Astrology is based on electro-magnetic radiations emanating from each of the moving bodies of the solar system and from the constellations of the zodiac. This electrostatic condition of the atmosphere can be detected in radio interference, and is as inherent and intrinsic as the force which moves the tides, and that which causes the compass needle to point northward.

London NW1 WM. P. ROST

CORRESPONDENCE...

The Alt Burgund Escapers

I HAVE been a reader of your magazine for many years. Recently I discovered in the archives of the Gestapo and SD of Estonia three secret documents about the escape of 46 Royal Air Force officers from the officers' PoW camp at Alt Burgund on March 6, 1943. On the next day the Assistant Chief of Gestapo and SD of Estonia, SS-Sturmbannfuehrer Geissler, issued a secret order (A-V, H1/Ma) describing the uniforms of the escaped British pilots and giving orders to seize the men when they reached Estonia. On April 2, 1943, this same Geissler, who was responsible for killing very many civilians in Estonia, gave a second order (A-V, 1129/43)—to seize 12 pilots who had not yet been recaptured: Sqn Ldr D. B. Gericke; Flt Lt J. B. Buckley; Fg Offs O. Cerney, A. D. Panton and D. T. Lumsden; and Plt Offs J. Thomson, J. Ricks, R. Edge, D. R. Lush, F. W. McKay, E. W. Foster and A. S. Ruffel. On this document the Chief of the Estonian Department (A-IV) of Gestapo and SD of Estonia, SS-Sturmbannfuehrer Ain Mere (who was responsible for killing 125,307 Estonian men, women and children) had written: "To arrange a general search and report to Dept V."

The third document, secret order No 052/43, A-IV, was issued by the same Mere: " . . . when the British flying officers are seized, their hands must be in a minute put in irons, or bound with wire, and stop up their mouths with a gag."

I wonder if any of them who escaped will see this and be able to tell of their experiences.

Tartu, Estonia E. MEOS

FORTHCOMING EVENTS

May	12	Institute of Navigation: "Airborne Weather Radar," by Capt R. C. Alabaster and P. L. Stride.
May	13-22	British Gliding Association: National Championships, Lasham.
May	16-18	Institute of Navigation (in conjunction with French and German Institutes): Convention on "The Avoidance of Collision at Sea and in the Air by Land- or Shore-based Aids," Dusseldorf.
May	18	RAeS Astronautics and Guided Flight Section: "The Agena Satellite and Discoverer Programme," by R. Smelt.
May	22	RAFA Air Displays, Hucknall, Notts, and North Weald, Essex.
May	22	SSAFA Air Display, Yeadon, Yorks.
May	22-24	IAS: National Telemetering Conference, Chicago.
June	2	RAeS Rotorcraft Section: "Development of Stabilizing Equipment for Helicopters," by P. D. MacMahon.
June	15	RN Air Station Lee-on-Solent At Home.
June	17	RN Air Station Yeovilton At Home.
June	17	Tenth Tactical Reconnaissance Wing, USAF, Open Day, RAF Alconbury.
June	17	RAeS Rotorcraft Section: Helicopter Rally and Garden Party, Dunsborough Park, Ripley, Surrey.
June	17	Opening of Bedfordshire Air Centre, Cranfield.
June	24	RN Air Station Arbroath at Home.
June	24	Bristol Air Day.

The First White Top?

I WONDER if any reader knows which airline was the first to paint its aircraft tops white? In 1950, in the Middle East, I was told by the president of Air Djibouti that his company claimed the distinction of thus painting aircraft in order to reduce their inside temperature when they were parked on airfields in the Red Sea area, where they were operating at that time. It would be interesting to hear of any earlier claims.

London SW13 M. A. JACKSON

THE INDUSTRY

Heated Pressure-air Supplies

CONTINUED extension of the de Havilland Aircraft Company's air-conditioning development department recently emphasized the need for supplies of air at high pressures, flows and temperatures, and it was decided that reciprocating compressors used in conjunction with a heat exchanger would meet the requirement.

Approached on the aircraft company's behalf through the Esso Petroleum Co, Urquhart's (1926) Ltd, oil-firing specialists of Greenford, Middlesex, were able to offer a system based on the use of an oil-fired heat exchanger supplied by Servotomic Ltd, of Victoria Street, London SW1, and fired by an Urquhart high-duty combustion chamber burning gas oil or residual oils. Designed for remote and automatic control, the exchanger is of simple design, consisting essentially of a fire-tube surrounded by finning within an outer shell. The compressed air to be heated passes along the finned annulus. Rating is 120lb/min of air raised from 50°C to a maximum of 400°C, and maximum working pressure is 200lb/sq in. Overall length of the complete unit is approximately 35ft and greatest diameter 2ft 9in.

Non-Ferrous-Metal Data

NOW available is *Metal Industry Handbook and Directory 1961*, well known as a standard work of reference for all concerned with the non-ferrous-metal industries. Up-to-date information on the properties of the newer as well as more familiar materials is given, and extensive summaries of British Standard, aircraft, DTD and Admiralty specifications have again been included.

A very wide range of producers, stockists and factors of basic products, machinery and tools, and metal-finishing equipment, is listed in a buyers' directory. The 560-page handbook also includes a section on the chief metal-finishing processes and data on rod, bar, sheet and strip products. Numerous conversion and other tables add to the practical value of the book.

Metal Industry Handbook and Directory—now in its 50th year of publication—is published by Iliffe Books Ltd, Dorset House, Stamford Street, London, SE1, price 21s (22s 9d by post). A complimentary copy is issued to all subscribers to the journal *Metal Industry*, the annual subscription rate of which is £3 7s 6d (overseas £3 12s).

IN BRIEF

Castrol 98, the synthetic aviation gas-turbine lubricant, has received MoA approval against specification DEng RD2487 (NATO code O-149, British Joint Services nomenclature OX-38). It is the first British oil, and one of only two in the world, to have received this approval.

The 1961 Petroleum Films Bureau catalogue of 16mm and 35mm documentary films has now been published; copies are available from the bureau at 29 New Bond Street, London W1. Films are available on free loan to flying clubs, those on aviation including features on the theory of flight, civil aviation and individual aircraft.

At Hayes recently 87 employees of the Fairey Group of companies and the Westland Group received gold watches in recognition of 25 or more years' service. Presentations were made by Mr G. W. Hall, chairman of the Fairey company, by Mr E. C. Wheeldon, managing director of Westland Aircraft, and also by members of the Long Service Association committee. Among those who received watches was Mr Alan Vines, a director of the Fairey Co Ltd.

Sir Arthur Vere Harvey, CBE, MP, has been appointed to the board of CIBA Ltd, Basle. This is the first time an executive of the CIBA Group in Gt Britain (Sir Arthur is chairman of the four British subsidiary companies) has been made a director of the parent concern. Some weeks ago he was appointed managing director of the newly formed CIBA United Kingdom Ltd, which is acting as holding company for all CIBA interests in Gt Britain.

M. L. Aviation Co Ltd have announced the appointment of Capt R. E. N. Kearney, OBE, RN (Ret), as Naval liaison officer. He retired from the Royal Navy in January this year after thirty-five years' service, his last two appointments having been Director of Naval Air Warfare at Admiralty (1957-58) and Chief of Staff to the Allied C-in-C Channel, a NATO post. Wg Cdr F. J. Oldland, OBE, AFRAES, RAF (Ret), is to continue as the company's RAF liaison officer. Mr V. A. Benning, AMIMECHE, for many years on the M.L. senior design staff, has been made chief draughtsman. This post was previously held by Mr A. J. Shirley, who joined the board of directors in November last year.

Mr Brian M. Lee, manager of the industrial division of Belling & Lee Ltd, has been appointed to the board of executive directors.

Alcan Industries Ltd announce that Mr C. J. Buchanan-Dunlop has been appointed manager of their Birmingham area sales office from May 1 in succession to Mr D. W. Taylor, who is to take over management of the London area sales office later this year.

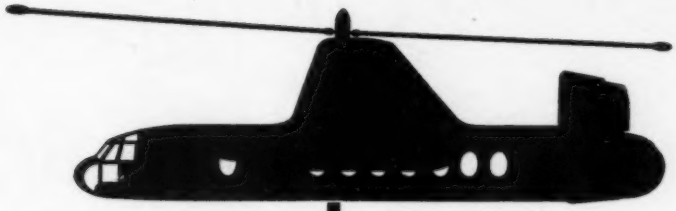
Two leaflets have recently been published by Elliott Brothers (London) Ltd, Century Works, Lewisham, London SE13, describing Size 11 stub synchros, which are currently in production, and Size 18 servomotors, which are being marketed shortly.

Fairey Air Surveys Ltd have been awarded a Ministry of Housing and Local Government contract to photograph and map a 1,730-acre area between Liverpool and Wigan in Lancashire as part of the Skelmersdale New Town project.

Mr Geoffrey Barnes, BSC, AMIEE, has joined the staff of Ultra Electronics Ltd as an executive engineer and has been spending a month in the company's research, development and production departments. He will subsequently be based at Shoreham with Miles Electronics Ltd as liaison officer for Ultra Electronics, who recently acquired a third share in Miles Electronics.

A leaflet from Hellerman Ltd sets out the characteristics of CRC 2.26—an anti-corrosion and anti-moisture treatment for electrical and electronic equipment—for which they are sole UK agents. The fluid is stated to be able to penetrate pores, cracks or holes and drive out moisture, after which it forms a protective film.

By Precision to Perfection, a new colour film describing the activities of the English Electric Valve Co Ltd, Waterhouse Lane, Chelmsford, Essex, was given its first showing in London recently. Founded in 1947 by the English Electric Co Ltd, the company design and manufacture specialized valves and pioneered (with Marconi's Wireless Telegraph Co Ltd) the 4½in-image Orthicon television camera tube.



THE MOST ACCURATE FLEXIBLE AND COMPREHENSIVE NAVIGATION SYSTEM FOR THE JET AGE THE DECCA NAVIGATOR

Only Decca provides the precise navigational information required for helicopter operations. Presented continuously on a pictorial display in the cockpit, Decca is a low frequency hyperbolic system giving high accuracy coverage down to ground level, unaffected by weather or intervening obstacles. The system is so precise that it can be used as an approach aid over more than one million square miles of Europe.

Decca's high accuracy at low altitudes makes it the only system that provides both close lateral separation in flight and flexibility in routeing.

The Decca Navigator Company Ltd London

THE Beaver JOINS THE BRITISH ARMY

Following a lengthy period of thorough evaluation, the Beaver was adopted by the British Army Air Corps in 1960.

Designated the A.L.Mk.1, the Beaver was chosen primarily for light liaison, communication, casualty evacuation and re-supply missions.

Because of its rugged dependability, generous load capacity and outstanding STOL performance the Beaver was the logical choice of the British Army for its exacting duties in many parts of the World.

THE BEAVER - DESIGNED AND BUILT BY

DE HAVILLAND AIRCRAFT OF CANADA

DOWNSVIEW, ONTARIO

MEMBER COMPANY of the HAWKER SIDDELEY GROUP

AIR COMMERCE

BAC-111s FOR BRITISH UNITED?

SINCE January, when British United announced their readiness to order five DH Tridents and four Vickers VC10s, this independent has been having second thoughts about its short-range equipment needs. Last February Mr F. A. Laker, BUA's executive director, told *Flight*—not for publication at the time—that his airline's interest was turning to the smaller jet projects being developed by BAC, initially the BAC-107 and more recently the BAC-111 (*Flight*, April 13, page 467).

As this issue goes to press it is expected that British United will place with BAC a provisional order, valued at more than £8m, for ten One-Elevens for delivery in 1964. It is thought unlikely that BUA will at this stage place a firm order for VC10s.

COACH-AIR 748s

SIGNING the £750,000 contract for three Avro 748s on Wednesday of last week, Mr Eric Rylands, managing director of Skyways Coach-Air, commented: "All of us in Skyways know that we have bought the best aircraft for the job. In fact, so sure are we of this that we are thinking of increasing the order." What this meant, he explained, was that the Coach-Air company were thinking of adding one aircraft a year in 1963 and 1964. Route proving with a production aircraft, the first of which is due to fly in June, will begin during the coming autumn, and services will start between Lympne and Beauvais next spring. A certificate of airworthiness is expected to be awarded by the ARB in August or September.

Skyways Coach-Air are thus to be the first operator of the Avro 748, which they are to equip with 44 seats. This is the same number as in the coaches which are used on the road part of the service between London and Lympne and Beauvais and Paris.

Initial utilization is unlikely to exceed 1,200-1,500hr because of limitations on night flying at Lympne. The 748s should reduce overall journey time by about 12-15min but efforts are also being made to speed up handling time on the ground. Although Lympne, like most other grass fields in south-east England, suffered from flooding last year—it was closed for a few days in the autumn—this was the first time it had been unserviceable for nine years, and the construction of runways is not contemplated. Skyway's managing director said that traffic on the Coach-Air service was this year 20-25 per cent greater than in 1960 and that it is hoped to carry 100,000 passengers this year. The company are interested in using the Avro 748 on other routes if licences could be obtained, and Skyways Ltd are also interested in operating freight services with the Argosy. They currently hold a freight licence to serve Moscow, subject to government approval.

Some 24 Avro 748s are now on order, four of them for India. The remaining orders are as follows: Skyways, three; Aerolineas Argentinas, nine; BKS, five; Aden Airways, three. Tropical trials with the first prototype are to be undertaken in Cyprus in June. The first Series 2 aircraft will be converted from the second prototype in mid-September and should fly in its new guise before the end of the year.

BEA WILL FIGHT

A RECENT leading article under this title (*Flight*, April 27) drew attention to the reactions of the corporations to a suggestion by Mr M. D. N. Wyatt, chairman of British United Airways, that they should discuss their future relationships. The chairman of BOAC, Sir Matthew Slattery, agreed to meet Mr Wyatt; Lord Douglas of Kirtleside, chairman of BEA, refused.

Subsequently BOAC issued a statement to the effect that "our chairman has had a friendly exchange of views with Mr Wyatt on the problems thrown up by the desire of the independent operators to operate regular services under the new Civil Aviation (Licensing) Act." *Flight* commented: "Unlike BEA, BOAC have accepted British United's simultaneous invitation to try to resolve their differences . . . But if our new Board is to do its job properly it must keep an eye on any *sub rosa* arrangements that might result, because these might defeat the purpose for which the Board was established—namely, to regulate, with full public accountability, Britain's fastest-growing public service industry."

In a letter to *Flight*, a BOAC spokesman writes: "There is no truth in the suggestion that BOAC have agreed to meet BUA round a table with a view to resolving any matters that are shortly to come before the ATLB. BOAC have certain fields in which they operate with BUA, for example routes to east and central Africa, and there may well be occasions when matters of mutual interest will be discussed."

Do BOAC now feel that, in meeting BUA, they may have compromised their position before the Board hearings are held, and that, by appearing to be ready to compromise, their bargaining powers would be diminished?

As a sequel, in the House of Commons on May 1, the Minister of Aviation, Mr Peter Thorneycroft, was asked if it was his policy that BEA and BUA should come to a private agreement with regard to certain British Airways routes, and whether he was aware that in reports in the Press he had been attached to these negotiations and that they had been successful with BOAC? The Minister replied: "I have nothing to do with them at all."

This impression shows an Avro 748 in the colours of Skyways Coach-Air, who have recently confirmed their order for three by signing the contract. Delivery will be in the autumn

TEAL BELONGS TO NEW ZEALAND

NEW ZEALAND is to pay Australia £NZ811,400 for its share in Tasman Empire Airways Ltd, which will now be wholly owned and controlled by New Zealand. The sale is effective retrospectively from April 1 but New Zealand is not required to complete the payment before March 31, 1965. Announcing this arrangement Mr McAlpine, Minister in charge of civil aviation in New Zealand, said that TEAL would have to earmark a fleet of jet aircraft fairly soon, whether it expanded its route network or not. New Zealand is now free to plan expanded services to Honolulu, the United States and to other places.

As a result of the purchase Australia and New Zealand must now conclude a formal air service agreement giving Qantas the right to fly to and through Auckland, Wellington and Christchurch, and the new TEAL the right to fly to and through Sydney, Melbourne, Brisbane and Norfolk Island. The position was, said the Minister, that New Zealand's new airline would develop in friendly co-operation with Qantas.

FUTURE OF THE ROTODYNE

IT has been suggested that Westland are to go ahead with the Rotodyne in anticipation of Government support, that they are not awaiting the results of the Ministry of Aviation's noise tests held over London last month, and that "it looks as though Westland have received an unofficial green light from the Ministry." A Westland spokesman cannot confirm these reports, noting that work is still going on according to the existing contract with the Ministry.

Obviously, this contract is not likely to get the Rotodyne developed and into production; but the Minister of Aviation, Mr Peter Thorneycroft, is thought likely to make a statement about the future of the Rotodyne in the next few weeks.

First flight of the Breguet 941 will be during the forthcoming Paris Show. Here it is just after emerging from its hangar for the first time

AIR COMMERCE . . .

AIR FREIGHT IS A SYSTEM

A FREIGHTER designed for civil use can be adapted for military operations, but a military freighter will never be satisfactory for air commerce. This conclusion, independently expressed by three aircraft manufacturers, emerged clearly from the Integrated Air Cargo Systems Presentation staged jointly by BOAC and BEA at London Airport last week.

Mr E. D. Keen of AWA said that the weight penalty of the rear-loading and dropping door of the military AW.660 was 1,000lb; this was the weight increase over the Argosy, which had been designed to have the lightest possible doors on a pressurized cabin. Mr H. G. Conway, deputy managing director of Short Brothers and Harland, estimated that in an aircraft of Belfast size the weight penalty of the rear loading door was 2,000lb, and fuselage space was not used in the most economical possible way. He then revealed that, as a result of a year's re-appraisal of cargo systems, Shorts are now offering a 100,000lb payload swing-nose freighter based on the Belfast and intended for North Atlantic service.

Every manufacturer of all-freight aircraft is now an advocate of pre-packaged loading in one form or another. This is the key to quick turn-round. In an aircraft of Argosy size, palletized loading on AWA's Rolamat system, it was claimed, could reduce turn-round time from 60 to 14min, and the increase in utilization on a 275-mile stage would raise profit—in theory at least—by a useful quarter of a million pounds. The new Belfast carries pre-loading ideas a stage further, palletized payload being lifted at two levels. Even passenger chairs would be palletized for installation, the fuselage becoming a sort of cupboard into which the freight is slid on shelves. The strong freight-floor as such disappears, all pallet loads being taken on the guiding rollers set into a light lower floor, this serving only "to catch the dust and provide a walkway."

The Best Freight of All

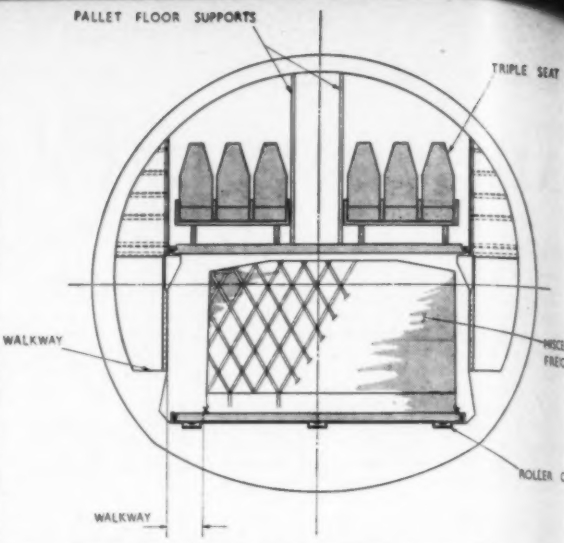
Two sub-variants of the aircraft are proposed, an all-freighter and a passenger-freighter, the latter carrying a payload of 55,000lb and 138 tourist-class seats on the upper deck. This translates into practical terms a conclusion of Shorts' recent cargo system investigation—that freighter aircraft should also carry passengers, the "best freight of all." The other main conclusion of the survey was that, for palletized loading, the maximum height of a load or a container should not exceed about 6ft. Hold size of the Belfast fuselage, which was designed to carry any load that could be lifted by the C-133, is 12ft × 12ft, so that two 6ft deep containers can be accommodated in the civil version.

Some 55,000lb of freight can be loaded onto the lower deck on ten stressed 7ft 6in × 11ft 6in pallets, slid into position on the built-in roller conveyor. Loads would be secured with a nylon net. Cargo for the top deck would be pre-packed into cages fabricated from welded steel tube to match the fuselage contour.

Since the cross-section is circular, passengers will be seated unusually far from any windows and under a sloping, attic roof. Carry-on baggage, it is suggested, could be deposited in the triangular space between chair and seat. The argument is that if £60 return fares can be offered across the Atlantic minor inconveniences would be accepted.

Perhaps the most intriguing part of Shorts' new project is a proposal for an automatic freight-loading dock, loading and offloading payloads of 100,000lb in 30min. From a marshalling yard of roller conveyors, the aircraft is loaded from a long trolley, which can be shunted across the airside face of the terminal to unload other aircraft.

A less elaborate scheme is proposed by AWA for the Argosy, the integrated freight handling system of which is based on the Rolamat conveyor. The system is now being experimentally examined by Riddle on Logair work. Argosy size, said Mr Keen, was compromised to achieve a design with the accent on freight handling rather than on absolute minimum direct operating costs, as this should yield a greater overall cost reduction to the operator.



Completely palletized loading is the important feature of Short's new swing-nosed SC.5 passenger-freighter version of the Belfast

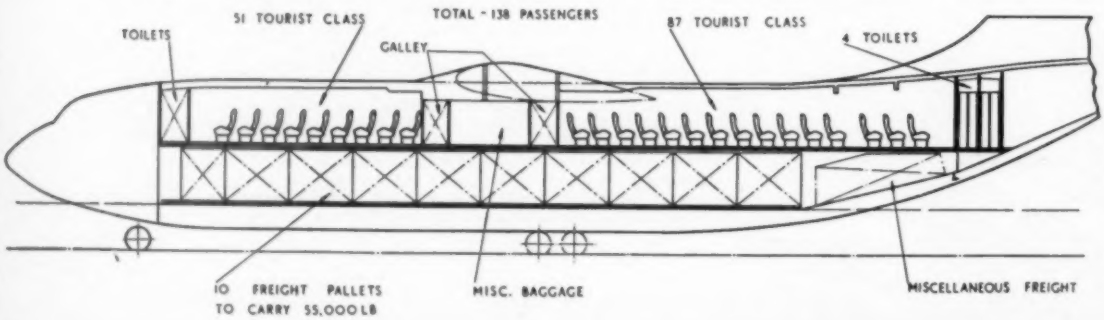
With the Argosy, the presentation continued, it was generally true to say that the fastest turn-round is the best economically, always provided that additional services could be scheduled in the time saved. In the system approach to air cargo, there was an exception to the axiom that "speed costs money"—a unitized cargo system distributed the work load evenly, so that a large labour force was not required at peak periods.

How big is a pallet? Or rather, what size should a standard pallet be? This was the question posed by Mr R. Stoessel of Lockheed, third of the aircraft manufacturers to be represented. It did not very much matter what the size was that was adopted, he said, but there was a strong case for standardization. He suggested a basic 76in × 76in location square on which any size of pallet could be mounted.

Six principles were advocated for the development of integrated air freight: (1) the use of pre-loaded pallets; (2) straight-in end-loading of aircraft; (3) ability for two pallets to be bridged by a single load; (4) use of stressed pallets; (5) construction of freight marshalling conveyor systems on which loads could, if necessary, be rearranged; and (6) a standard gauge for pallet conveyors.

Another comment from Lockheed was that military freight was very much like commercial freight, a point also emphasized by Mr C. I. Becker of the Alvey Ferguson Co of Cincinnati, who spoke about electronics and warehouse order-picking systems. From experience of the highly mechanized Ocama freight terminal at Tinker AFB, Oklahoma, he said that of all USAF freight handled, 80 per cent did not exceed 30lb weight and 61 per cent was not above 10lb or 1 cu ft. Only 1 per cent of all loads weighed more than 500lb or exceeded a 4ft cube in size.

Perhaps only broad conclusions can be drawn from the corporation's recent combined look at the integration of air freight with ground handling systems. A co-ordinated system must start either at a special marshalling shed or, better still, when the consignor loads pallets for despatch. The day of the individual package and the fork-lift truck may soon be passing, but there is no general agreement as yet about the loading system that should replace it. Although Lockheed claim that their experience with truck-loading and a simple bridge plate has been successful, many operators feel that vehicles and aircraft should be kept well apart. AWA rely on Rolamat bridge pieces to join truck and aircraft, compensating in this way for differences of loading height. Other systems include loading piers and extendable conveyors, most of which demand accurate positioning of the aircraft. The scissors-lift platform may also figure in integrated systems. These are ideas for BOAC and BEA to think on, in planning not only their freighter fleets but the supporting systems which it is now accepted must go with them.



By dispensing altogether with a freight floor, a highly flexible loading arrangement is possible. Rollers in the fuselage side can support either passenger-chair pallets or another 45,000lb of packaged freight

A CONSOLIDATION OF CONSOLIDATORS

As the richest air route in the world, the North Atlantic has always been a testing ground for new economic ideas. Tourist-class and economy-class fares, for instance, were first introduced on this route and have subsequently become the standard pattern throughout the world.

Upon the most significant development on the North Atlantic the industry is strangely silent. It is the increasing influence of the wholesaler, the professional consolidator, in regular air transport. It is of course true that the industry is having a dispute about the modernization of the now outdated freight tariff on the North Atlantic. There has also been growing disquiet about the activities of non-scheduled charter operators. Yet, in each case, the root of the problem—the advent of the middleman—has escaped almost without notice.

The recent pitched battle in Paris over North Atlantic freight rates has been widely held up in public as a contest between the broad-minded—particularly PanAm, Seaboard and TWA, who wish to develop a large-scale freight movement by a combination of specialized freighter aircraft with very low fares for bulk shipments, and the narrow-minded—principally the smaller European carriers—who are primarily interested in utilizing their Boeing 707s and DC-8s in the most economical manner. This division, which is in fact somewhat misleading, is as old as transport itself and exemplifies the two classic schools of rate-fixing theory: on the one hand, those who believe that rates should be based upon the long-term cost of providing the service (in this case of freighter aircraft); on the other hand, those who endeavour to charge what the traffic will bear.

But there are two reasons why this neat division of interest is so misleading in the case of North Atlantic freight rates. In the first place, it contains the inherent suggestion that one group is pressing in a disinterested, public-spirited way for reduced rates, only to be obstructed by a second group whose only object is to squeeze the oranges till the pips squeak. In the North Atlantic freight conference this situation just did not exist. Excluding the protectionist lunatic-fringe which inhabits most such conferences all the North Atlantic airlines were agreed on the pressing need both to simplify the tariff and to increase the volume of business by offering reduced rates. The basic problem was not one of ends but of means, with each rival group convinced that its system was the best, the other group being bound in time to see the folly of its ways.

Mass-market Bid

The major specialists, such as Seaboard, PanAm and TWA, are convinced that their salesmen will find paradise on earth in the form of a simple tariff, based upon break-points at various levels which fall from about 50c per ton-mile for small packages down to about 20c per ton-mile for single consignments of over 10 tons, and—in the case of Seaboard—to less than 15c per ton-mile for massive CL-44 type shipments of over 30 tons. This would allow the airlines to penetrate the mass market for freight and would put the whole business on to a completely new footing. This, it is argued, is necessary if for no other reason than the need to do something about the astronomic rise in freight capacity. Seaboard, for instance, will by the end of this year be offering alone as much capacity as all carriers combined were offering last year.

The opponents of the scheme, on the other hand, argue that this system would in practice result not in an increase but in a reduction of business and an increase in effective rates, for the withdrawal of low specific commodity rates for traffic moving now in modest quantities would mean that this traffic could not afford the charges at the higher end of the scale proposed by the specialists. In other words, a substantial volume of commodity-rated traffic is now taking advantage of rates which would only be available for very large consignments under the specialists' scheme. Believing that the loss of existing traffic will not be compensated by new traffic moving at the new bulk rates, these airlines refuse to accept the views put forward by the specialists.

Superficially, there might appear to be room for compromise between these two extreme views. In practice the scope here is very limited, for the arguments put forward above only represent half the story. To understand the other half, it is necessary to appreciate the peculiar problems which are being created by the consolidator. In its wisdom the CAB allows freight forwarders to charter aircraft and then to resell the capacity at normal rates. If the regular airlines are going to prevent this booming business from going to non-scheduled operators, then they must be prepared to offer an incentive to the freight forwarders. The only acceptable incentive would be a sharp break-point at about the 10-ton mark. In nine cases out of ten this would be equivalent to a whole-aircraft charter rate. By cunning choice of rate at this break-point it would be possible to beat the non-skeds at their own game. Needless to say, it is possible to get more airlines to agree to this particular bulk break-point than will be found to accept the bulk philosophy in total.

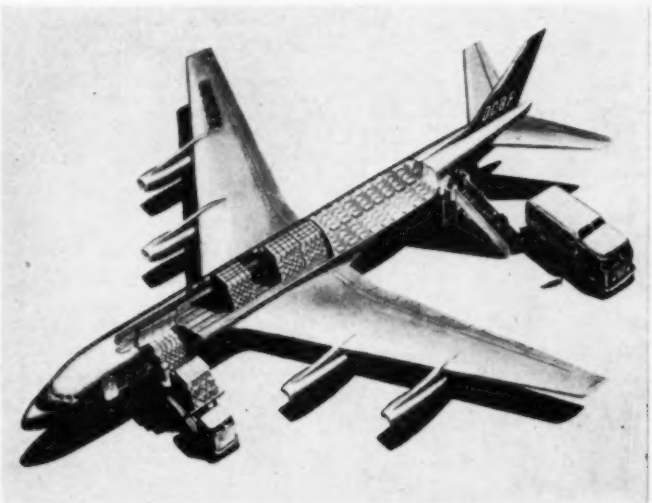
It is one thing to fiddle with the existing tariff to keep the non-skeds at bay. It is quite another to take control of freight marketing out of the hands of airlines and to put it in the hands of freight forwarders. Many airlines are certain that the advent of middlemen in this instance will not be to create new business but merely to carry the same volume of business at lower rates to the airlines. Shippers would still pay the same charges as at present, the freight forwarders being the only customers generally able to utilize the bulk rates. In other words the only effect of the bulk break-point scheme would be to take money away from carriers and to give it to merchants. Airlines also argue that an even more damaging longer-term result would be that the advent of the wholesaler would lead to the airlines relinquishing their responsibility for freight marketing policy. In the last analysis, then, the crux of the problem which faced the North Atlantic freight carriers when they recently resumed their discussions in Montreal was to find the answer to this question: "Are freight forwarders friends or foes?"

The same question in another form faces the North Atlantic scheduled carriers in regard to their passenger services. The position that is developing here is that an increasing share of business is in the form of package tours and closed-group charters. As in the case of freight, it is the non-scheduled operator who has started the ball rolling, again with the active encouragement of the CAB, whose declared policy is that bulk air travel is an entirely new market. For various reasons—not least of which is the wish of Mr Kennedy's administration to foster the flow of European tourists to the United States—the CAB is fairly liberal with the granting of exemptions to allow both scheduled and non-scheduled carriers to participate in the market for bulk travel. The fact that most of the scheduled airlines have surplus capacity in the form of under-utilized piston and turboprop fleets is enabling them to meet the non-skeds face to face. But by entering the charter business on a large scale themselves, the scheduled carriers are only highlighting the wide gap between regular fares (minimum return London-New York just over £160) and charter fares (average about £80 return).

As in the case of freight, this wide gap presents opportunities to middlemen such as did not exist when charter services were restricted to a few relatively weak charter companies. But as soon as passenger chartering becomes big business, the possibility of organization and consolidation becomes infinite, for hardly a person does not belong to some group or other. As long as the arrangement was in the hands of unpaid honorary secretaries, the chances of material diversion of traffic from scheduled services was remote. But once the arrangements are taken over by professional organizers who employ teams of salesmen working their smooth way steadily through university common-rooms, through the offices of learned societies, and into clubs of every description, then the diversion of traffic from normal rates to bulk rates is such as to cause headaches to airline managements.

1961 will probably go down as the year when the consolidation of freight and passenger traffic really became an issue on the North Atlantic. If in this case the consolidators win the day, it will not be long before they invade Europe.

This is the first impression released by Douglas of the DC-8F Jet Trader—the aircraft that the company are offering as a combined passenger/cargo transport, with accommodation for 54 passengers and 52,000lb of freight. First flight is scheduled for August 1962. Details were published on these pages on April 20



Trailing vortices from its flaps, the Vanguard in this photograph is approaching over new Mazda 200W sodium linear approach lights and projectors which are being tried out on the main runway at Stansted. Manufactured by the AEI Lamp and Lighting Co, they are said to be effective in reducing glare

AIR COMMERCE . . .

CHARTER AIRLINE FOR SCOTLAND

A NEW company, Caledonian Airways (Prestwick) Ltd, has been formed with a nominal capital of £25,000 to operate passenger and freight charters. Accommodation has been applied for at Prestwick Airport where it is intended to set up a base; another is to be at London Gatwick.

A spokesman of the company said recently that it was proposed initially to operate with two aircraft, probably DC-7Cs, from late this year or early next year. Caledonian will compete for business in the inclusive tour market, for which they believe a considerable potential exists in Scotland.

BUSES AND FERRIES

MORE interest might previously have been shown in Armstrong Whitworth's AW.670 Airbus and Air Ferry developments of the Argosy had they been less expensive. Few British independent airlines were in a position a year or two ago to order aircraft costing nearly £½m, particularly the ultra-short-haul car ferry operators who, at low utilization, would have had to face amortization rates representing a substantial proportion of aircraft revenues.

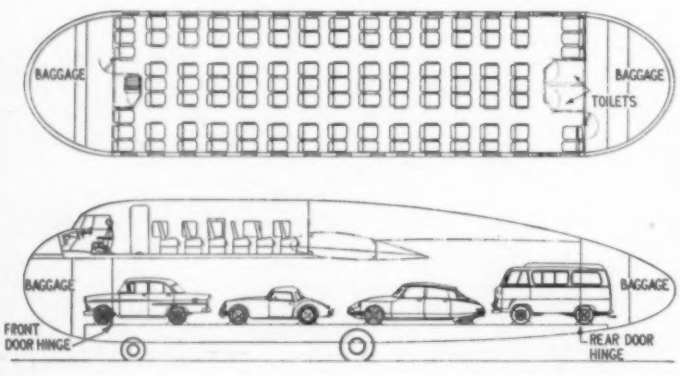
The AW.670 has now been adjusted to approach more closely to 1961 ideas on aircraft for intra-European operations. On page 617 of this issue Mr Harold Bamberg, chairman of Cunard Eagle, refers to his ideas about an aircraft for European routes as "something possibly with a fixed undercarriage and four reliable powerplants." Both are features of the AW.670. The Air Ferry aircraft has also been improved with the provision of adequate space for eight cars 5ft 6in wide, and room in which to lash them down.

The AW.670 now has a new double-deck fuselage 58ft long by 15ft wide at floor level and 7ft 1in high, giving a usable rectangular volume of 6,150 cu ft. Overhangs of 1ft 6in and 2ft 4in into the front and rear doors respectively increase the available hold-length to 61ft 10in for car ferrying. Hold-height increases to 9ft 2in immediately aft of the rear spar; and the rear door opening, 8ft 6in high, is large enough for most touring caravans. The full-width freight doors can be manually or power operated, and the floor-sill height is 4ft. Up to 32 passengers can be accommodated on the upper deck, or 30 if a toilet is provided.

The Airbus can carry 102 passengers in the main hold, seated six-abreast at approximately 40in seat-pitch, over a 340 n.m. stage with full SBAC reserves, or 114 passengers over a 160 n.m. stage with the same reserves and at 34in pitch. A buffet is not normally carried, but two toilets are provided at the rear of the cabin.

Except for a fixed, faired nosewheel the undercarriage is the same as that of the AW.660, but the Air Ferry can have a convertible fixed undercarriage, when forward and centre undercarriage doors, hydraulic services, retraction jack and locking-spring unit are removed in favour of a locking strut. Fairings and wheel spats are fitted; the latter, in halves, with the wheels off. Fittings to secure the main fairings are then clamped to the undercarriage legs, and the leading edges and side portions of these fairings are attached to the forward and centre door hinge brackets respectively. All fairings are secured by screws and quick-release fasteners, access panels being provided for servicing and fuelling.

The Air Ferry can carry eight cars in two rows of four, with central and side gangways. Car-lashing/seat-attachment points, into which hand-locked fasteners can be inserted, are located at 2in longitudinal and 20in lateral pitch over the entire length of the floor. Baggage can be stowed in either side of the clamshell doors. Loading and unloading are made quicker by having the starboard row of cars facing forward and the port row facing aft. The vehicles can be driven off without reversing; and, if the ramps are full width no marshal is required to direct the drivers.



Illustrated here are the two new versions of the AW.670, the 102-passenger Airbus above, and the Air Ferry, which can accommodate eight cars and 32 passengers, below. A caravan can be accommodated in the rear fuselage and provision is made for fixing down the undercarriage

TWA'S BIG JET ORDER

AT a cost of more than £66m TWA is to buy 30 more Boeing 707s. Six are to be 707-331Bs, twenty are to be 707-131Bs, and four 720Bs will be leased. All are Pratt & Whitney JT3D-3 turbofan powered and all thirty aircraft will be delivered between September, 1961 and October 1962.

TWA at present has in service rather more than 30 of the 47 jets which it previously had on order—fifteen 707-131s, twelve 707-331s and twenty Convair 880s. It is interesting that, while the Boeing fleet is to be increased very substantially, the order for Convair 880s is to remain unchanged. This big new order brings the total Boeing order book to only four short of 400 aircraft, not including the four leased 720Bs. TWA will now have the second largest jet fleet outside of the Soviet Union. BOAC is the airline which has the largest number of jets in service or on order—19 Comet 4s, fifteen 707-420s and forty-five VC10s. BOAC will order another three 707s if Treasury approval is obtained but three aircraft would be sold when the VC10s are delivered.

Simultaneously with the announcement of the Boeing order by TWA's president, Mr Charles C. Tillinghurst, Jnr, a new chairman was elected to succeed Mr Warren Lee Pierson. He is Mr Ernest R. Breech, one of the trustees appointed last December to control the shareholding relinquished by Hughes Tool.

SAS IN TROUBLE

THE image that SAS has over the years projected of itself as a model of airline efficiency and international co-operation has, in the last six months, faded. As a note on page 224 of *Flight* for February 17 1961 showed, SAS has the lowest staff productivity in terms of both capacity and flying hours produced among the world's dozen biggest airlines.

All the Kr210m (£11m) put into SAS in 1950 must be considered lost, reports a committee of Scandinavian Government officials that met in Copenhagen on April 25. The committee was composed of Government officials from Denmark, Norway and Sweden, and its recommendation that Kr280m (£14.5m) should be provided was endorsed by the transport ministers of the three countries concerned. The committee could not guarantee that SAS can be kept operating without further loss, and no profit could be expected for three years.

As reported in *Flight's* review of SAS's annual report last week, the airline made a loss of about £6m in 1960 on revenues of £45m. It is estimated that the loss for the present financial year, ending September 30, 1961, will probably be more than the £2.7m estimated, according to the committee's report, which further criticizes "extravagant spending" and recommends an overhaul of the company's leadership. A condition of the provision of new capital is that in future SAS must be run on strictly business lines, even if it interfers with the prevailing division of activities [2 : 2 : 3] between the three countries.

On the line at San Diego is the fourth Convair 990 and the first to be painted in airline markings. Two aircraft are now undergoing flight tests, another is on a proof-loading programme, and two more will join the flight-test programme within the next two months. Delivery of 25 to American should start in December

BOAC'S SWINGS AND ROUNDABOUTS

IT is disappointing to record that in 1960-61, a year in which BOAC reduced its cost level to the remarkably low figure of 30d per c.t.m., the corporation is sure to show another financial loss.

The pattern is a familiar one: on operations alone, the balance of income over expenditure was just sufficient to cover interest payments of over £4.5m, although the margin was only about a third of that in the previous year. The niggers in the woodpile were the associated companies, the joint loss on whose operations has risen from £1.1m to £1.8m, so that the overall loss this year is likely to be about £1.7m.

When it is recalled that only a few years ago BOAC was struggling to reverse its trend of cost levels from the high peak of 40d per c.t.m, the financial results of the associated companies overseas must be regarded as sadly unsatisfactory by those at home—and in particular by BOAC's re-vitalized engineering staff, whose efforts (helped by the big work-capacity of the Boeing fleet) have been mainly responsible for reducing cost level from 34d per c.t.m. in 1959-60, to 30d in 1960-61.

While it is not clear from the provisional figures just released by BOAC which associate companies suffered most heavily, there has been no recent evidence to show that Kuwait Airways and BWIA have fared any better than they did last year, when their losses totalled about £800,000. Middle East Airlines, on the other hand, maintained a reasonably satisfactory financial position in a year in which they first introduced jet equipment. They hope to break even. The purchase by BOAC Associated Companies of Bahamas Airways from Mr Eric Rylands in December seems unlikely to have lightened BOAC-AC's liabilities (*Flight*, April 20, page 545).

Commenting on the provisional figures—more detailed than any the corporation has previously announced prior to publication of the annual report and accounts—Sir Matthew Slattery, the chairman, said: "Every effort is being made to remedy the situation, but the taking of positive steps is made difficult by political and other considerations, and it should not be thought that the necessary improvements in financial results can be effected quickly."

Profit on BOAC's own operations before interest payments was £4.75m, about £0.5m more than the previous year. Revenues from traffic that increased by 30 per cent were £88.5m, about a quarter more than in 1959-60. In 1960-61 a total of £10m was written off against obsolescence. In the previous year the allowance was £7.5m.

Sir Matthew said that this year BOAC's total capacity would be increased by 35 per cent, and on Atlantic routes by 42 per cent. For the first time in the corporation's history the sales target was now well over £100m.

BREVITIES

From August 1 this year a flight test will be included as part of the examination for a flight navigator's licence.

Australia is short of commercial pilots, and is likely to require another 1,000 in the next four years. More than 600 are likely to be absorbed by airlines.

Air-India are now operating a weekly Boeing 707 service between Prague and New York, the first between any Eastern European country and the United States.

Seaboard and Western Airlines have changed their name to Seaboard World Airlines. A new form has been adopted for the initials SW which appear on the fins of Seaboard aircraft.

BEA is to have a stand at the British Trade Fair in Moscow, opening on May 17. BEA and Aeroflot between them will be operating 35 extra flights in May and June during the period of the fair.

New appointments in Silver City Airways are those of Mr Leslie McCracken, who becomes general traffic manager; Mr Leslie Roy Pavey, general sales manager; and Mr C. John Barron, commercial superintendent.

A direct Comet service to Stockholm is now being operated by BEA in pool with SAS, who are using Caravelles. BEA Comets will be used on the routes to Lisbon, Düsseldorf and Geneva this summer for the first time.

An FAA certificate was awarded to the turbofan-powered DC-8 series 50 on May 1. This followed a 6,890-mile non-stop flight from Long Beach, California, to Rome on April 21, when a Series 50 averaged 605 m.p.h. over the route.

A new airport charge known as a "general terminal charge" will be introduced at Montreal International Airport, Dorval. As from June 1 a Boeing 707 will pay for the use of the terminal building an additional $25 on an international flight and $12.50 on a domestic service. For a Vanguard the fees are $18 and $9. From April 1 next these charges will be doubled.

Mr Richard Willis has been appointed planning manager of Cunard Eagle Airways, responsible for forward planning and development.

In a sales management reorganization BOAC have grouped passenger and cargo sales under separate managers, to provide more specialist treatment for the growth of air cargo business.

CL-44s for Seaboard World Airlines and Flying Tiger have come out 1,500lb under guaranteed weight. Both operators will start services with the swing-tails in July.

Air Safaris operate eight Vikings—not three Vikings as stated in the caption to a photograph on page 577 of our issue of April 27. Four Hermes are also operated.

BOAC Boeing 707 services between London and Los Angeles are now being operated three times weekly. Services to Toronto, which were increased to twice weekly on May 5, will operate three times weekly from May 17.

Handled by a crew of Russian test pilots, an An-10A has flown a 310-mile closed circuit at an average speed of 453 m.p.h. Between turns the aircraft exceeded 465 m.p.h. The Russian statement says that to maintain speed the aircraft made very short-radius turns at a bank angle of 60°.

The new terminal building at Birmingham Airport, Elmdon, was opened on April 28 by the Duchess of Kent. Costing £130,000, the new terminal has Customs facilities, a public restaurant, and viewing terrace. It is part of a scheme to modernize the airport, which was opened by Her Royal Highness in 1939.

Isle of Man landing fees were revised last month to bring them into line with the new UK charges. Exceptions are that a passenger service charge of 1s is levied on both departures and arrivals, but if no passengers are handled the landing fee is reduced by 50 per cent. Landing or take-off outside public hours attracts an 85 per cent surcharge if less than 48 hours' notice is given.

Fairchild are now delivering to executive operators a version of the F-27 known as the F-27F. Powered by Dart Mk 529-7Es, it has a maximum weight of 38,500lb and can operate from 3,700ft runways. Landing and zero-fuel weights have also been increased. The F-27F incorporates as standard much equipment that was optional on the F-27 and F-27A.

Mr Frederick Beezley, former legal assistant in the Office of the Director of Public Prosecutions, is reported to have joined Falcon Airways as assistant managing director to Capt Kozubski. Mr Beezley was concerned in the prosecution of Independent Air Travel, of which Capt Kozubski was managing director at the time of the Southall Viking accident in September 1958.

A new livery has been designed for BUA's helicopter fleet. It is seen here on a Widgeon at Redhill, the company's helicopter base. This machine is normally stationed at Battersea Heliport

SERVICE AVIATION

Air Force, Naval and Army Flying News

Change at Upavon

IT is announced that AVM Charles Broughton, CBE, SASO at Transport Command headquarters, RAF Upavon, since May 1958, is to be Director-General of Organization at Air Ministry from June 8; he is being succeeded at Upavon by AVM F. S. Stapleton, DSO, DFC, who has been Head of the United Kingdom Joint Services Liaison Staff in Canberra, Australia, since February 1959.

More Interdependence

WHEN he visited Wattisham on May 1, the date on which Fighter Command came under the Supreme Allied Commander Europe, the Minister of Defence, Mr Harold Watkinson, said that he believed the command's integration with Western European air defence was "the right thing to do." He added: "I am quite clear in my mind that in NATO we have really got to learn to be more interdependent and unified in our systems of defence and weapons and flying"; Britain had put these beliefs into practice and he hoped other NATO countries would do the same. Speaking later about defence, in the context of his visit to North Coates and a scramble at Wattisham by Lightnings and Javelins, Mr Watkinson said, "you must insure against all forms of attack. The time may come when there will be a missile stalemate. I don't think the Bloodhound-Lightning set-up is an over-insurance."

Like Fighting Cocks

OVER 70 members of No 43 Sqn (Fighting Cocks) Association attended this year's recent annual dinner [writes "J. Y."], another 70 sending messages of regret at being unable to attend. The seating-plan was on the basis of Spit Brigade, Sub-sonic and Biplanes, Meteors and Mach 1; tables were decorated with *Flight* air-to-air photographs taken over the past 31 years.

The chairman was to have been the vice-president, AVM C. G. Lott, who had the squadron in 1940; but he gave place to the president, Lord Douglas, who was the first member and became the first CO in 1916. Lord Balfour, too, was there: he was a flight commander in 1916. Sitting next to him was George Lingham, of Heston Aircraft, a 43 pilot in 1917.

Lord Douglas recalled the days of the Sopwith 1½-Strutters and said that now, as chairman of BEA, he could see from his office at Northolt the actual spot from which the unit took off for France in 1916. Lord Balfour, referring to the presence of nearly all the current pilots, said the old members were grateful to the new for carrying on the high traditions of the Fighting Cocks.

Sqn Ldr D. McScrimgeour, who has just relinquished command, apologized for non-attendance last year, because of detachment to Cyprus. Sqn Ldr P. G. Peacock, who at the date of the dinner had commanded the squadron for exactly three days, said it was nice to meet the association's members. If the unit went abroad, it might be difficult, he thought, to attend next year's function unless some outside help was forthcoming —a remark directed to the chairman of BEA.

The occasion was organized by Jimmy Beedle, secretary of the association.

What the well-dressed RAF aerobatic pilot is wearing this season: Sqn Ldr Brian Mercer, CO of 92, in the white overalls and red and white scarf, de rigueur for the new Fighter Command team, which is to be called "The Falcons"

Bulwark in Borneo

COMMANDO troops were put ashore from HMS *Bulwark* off the North Borneo coast in the recent SEATO exercise Pony Express (this page, April 27). With the carrier anchored some 12 miles off the coast her 16 Whirlwinds left for the shore at intervals of a few seconds, carrying four men on each sortie. There was only one mishap, when one of the helicopters toppled over on landing and crashed downhill, its occupants being shaken but otherwise unhurt.

Wearing the disguise of a flight lieutenant, the vice-chancellor of Southampton University, Dr D. G. James (right), made a flight in a Canberra of No 245 Sqn from Tangmere with the station commander, Gp Capt W. D. David. Dr James is believed to be the first university vice-chancellor to fly in a high-performance RAF aircraft

Morale of No 2 Sqn pilots seems unaffected by the loss of their Swift FR.5s, last of which was recently flown home to the UK ("Flight," April 20). The CO is Sqn Ldr C. E. MacDonald

Per Ardua . . .

WAS it because an actress called Lily Elsie with "direct access" to a member of the Air Council favoured the colour, or was it because a million yards of sky-blue cloth lay unwanted in British warehouses when the Russians (for whose cavalry it had been ordered) collapsed in 1917, that the RAF started to wear sky-blue instead of khaki? This is one of the facets of Royal Air Force history [writes "H. W."] discussed in a new book by Sqn Ldr Peter Hering,* who devotes one of his chapters to the motto "per ardua ad astra," apparently considered untranslatable. What is wrong with "through steep places to the stars," with its symbolic overtones and (for these spaceflight days) realistic implications?

Practically everything the RAF has gathered to itself in 40 brisk years (not long enough for it to have become as lichen-covered with tradition as the Army and Navy) is delineated in this useful book, from the bandmaster's glass of port to the abolition of leggings in India, from F/Sgt Lewis the Halton mascot to the No 204 Sqn badge designed by Lawrence of Arabia when he was AC Shaw. Only one thing is missing—an index. But the book is very clearly laid out; so that anyone who really wants to know why the air gunner's badge had twelve feathers, or why RAF standards include leeks in their design, can quickly find the answers.

* *Customs and Traditions of the Royal Air Force*, by Sqn Ldr P. G. Hering. Gale and Polden Ltd, The Wellington Press, Aldershot, Hants. Illustrated. 15s net.

IN BRIEF

Britannias and Beverleys of RAF Transport Command airlifted over 2,000 men of No 16 Independent Parachute Brigade and their equipment from Britain to Cyprus last week for Exercise Fabulist.

The Air Public Relations Association annual general meeting and informal reunion is being held at The George, George Court, the Strand, London, WC1, on Thursday, May 18 from 6.30 p.m.

Gp Capt Douglas Bader, who lost his legs in a flying accident in 1931 but rejoined the RAF and became one of the outstanding fighter pilots of the Second World War, was guest of honour at a National Sporting Club dinner in London recently. He was presented by the chairman, Mr Charles Forte, with a silver cigarette box. Among the guests was Mr Kenneth More, the actor, who played the part of Bader in the film *Reach For the Sky*.

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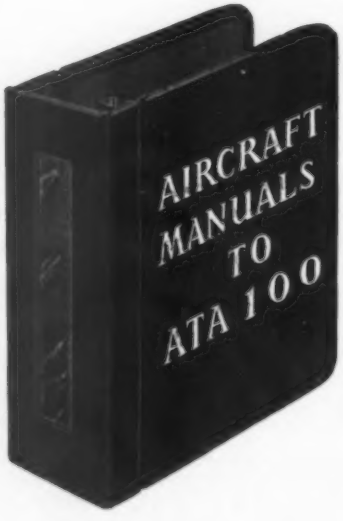

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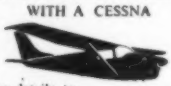

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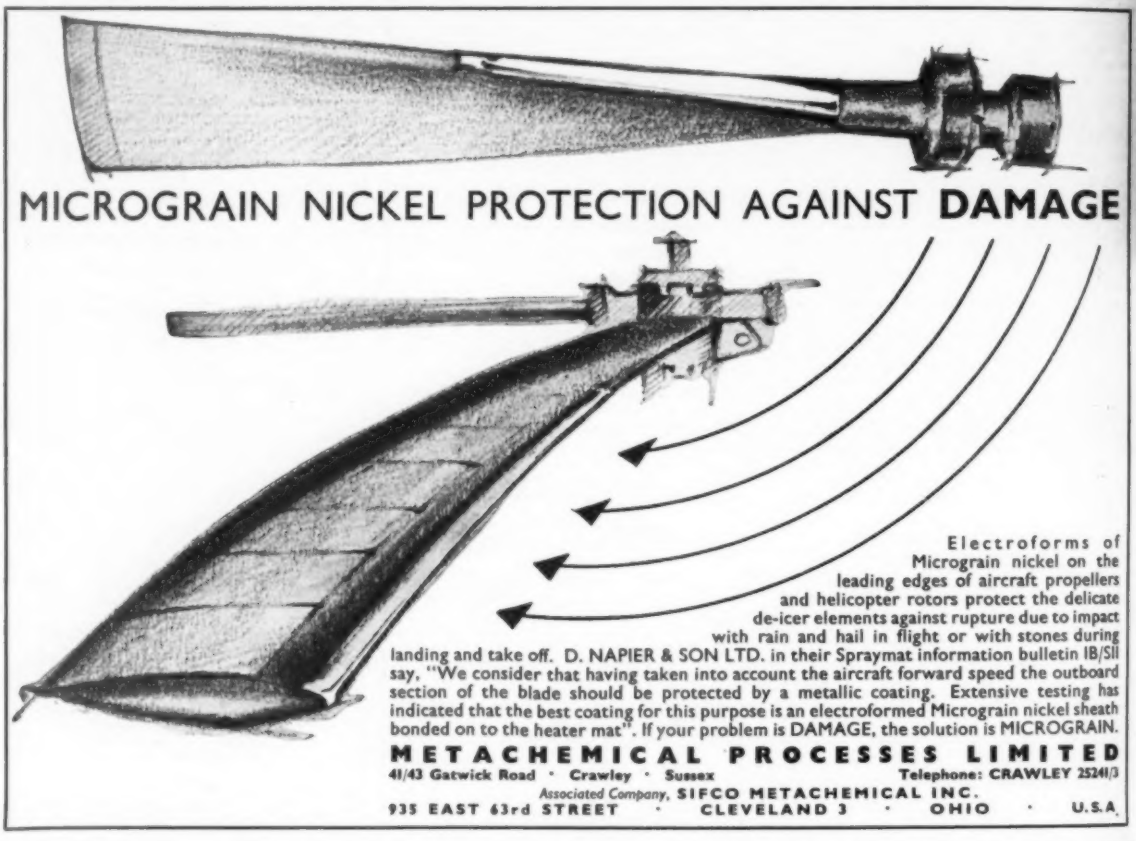

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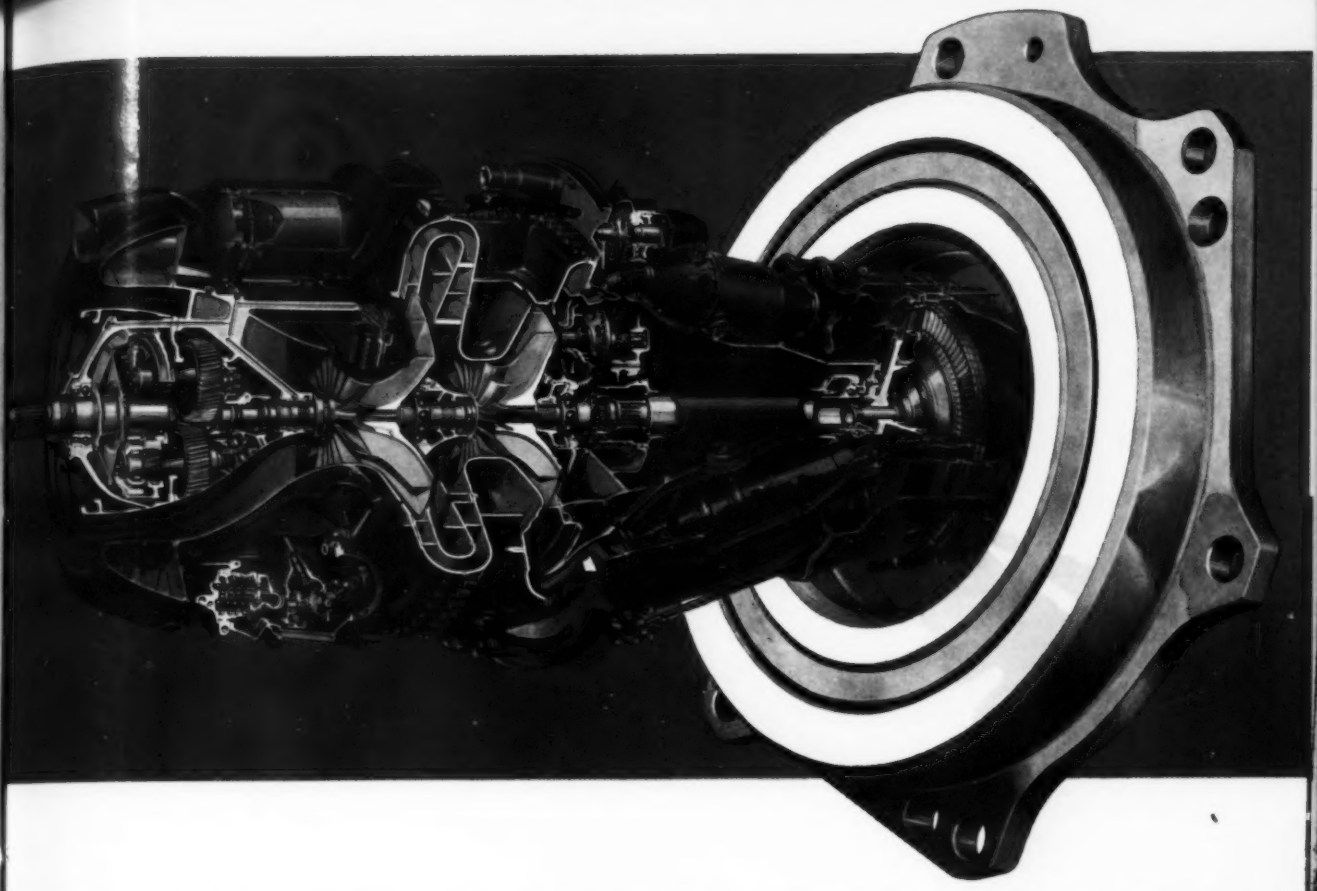

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